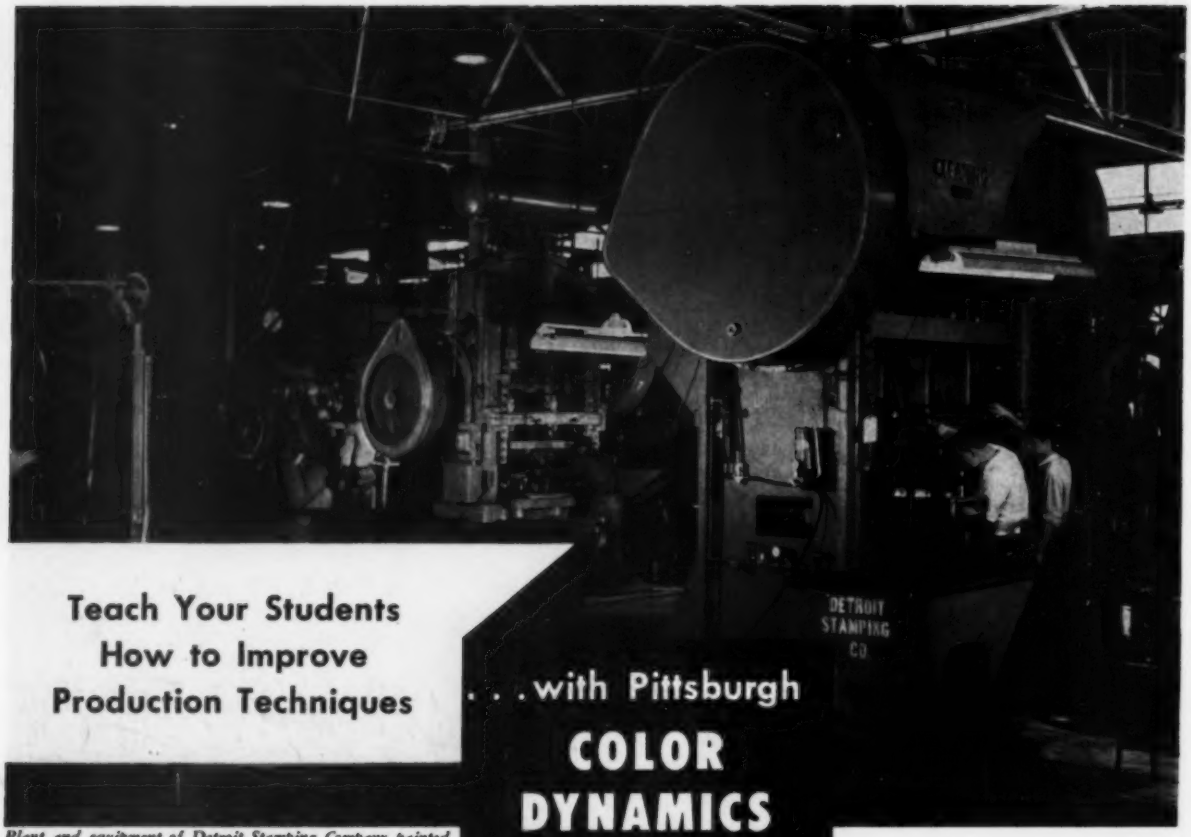
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION



Plant and equipment of Detroit Stamping Company painted according to the principles of Pittsburgh COLOR DYNAMICS.

Teach Your Students How to Improve Production Techniques

. . . with Pittsburgh

COLOR DYNAMICS

● *Higher efficiency, better morale and greater safety are traced directly to use of modern scientific painting system*

How can color be used to focus an operator's attention more closely on his task?

What color arrangements can be utilized to reduce the number of accidents and to increase safety?

What combinations of color will improve working conditions and labor relations?

● **Answers to these** and many similar questions are to be found in Pittsburgh's new science of COLOR DYNAMICS, a modern painting system based upon the principles of the *energy in color.*

Today's production executive must know how to use color effectively in plant maintenance in order to turn out production effectively. That's why many industrial and vocational schools include COLOR DYNAMICS in their training courses. In this system, colors are classified according to their influence on people. *Focal* colors lessen eye fatigue and nervous tension. *Eye-rest* colors relax the eyes of workers. *Morale-building* colors promote cheerfulness and reduce mental depression. *Safety* colors reduce danger of accidents by warning of impending danger.

● **COLOR DYNAMICS** has been applied successfully in hundreds of leading plants throughout the country. It is now recognized as a distinct advance in modern production technique. Begin now to teach it to your students.

How you can get a COLOR DYNAMICS Engineering Study—FREE!

A good way to impress the advantages of COLOR DYNAMICS upon your students is to paint the walls, floors, ceilings and machines of your class rooms with COLOR DYNAMICS. We'll be glad to make a scientific color engineering study for you FREE and without obligation.

There's a color expert at each of our offices located in all principal cities. Call your nearest Pittsburgh Plate Glass Company branch and arrange to have our COLOR DYNAMICS representative call on you at your convenience. Or send this coupon.

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Before machining skill is acquired, machine handling must be learned. With South Bend Lathes, it's easy. In fact, machine handling quickly becomes routine. This is the result of the simplicity of these precision lathes.

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Students do not have to concentrate on the manipulation of controls with South Bend Lathes. Their attention can be applied to their work. This means faster, more thorough acquisition of machining skills. There will be less work spoilage from faulty machine handling, and less supervision will be required. If you are planning a new shop installation, or replacing present equipment, it will pay you to find out about *all* the advantages of South Bend Lathes. *Write now.*

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SOUTH BEND, INDIANA
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South Bend 13" Quick Change Gear Lathes in Newark (N. J.) East Side High School

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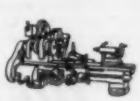
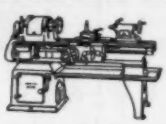
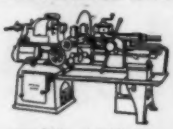

☐ 9" and 10" BENCH LATHES


☐ 10" to 16" FLOOR LATHES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Rockford 16″ Economy Lathes offer unbelievable first-line features in this medium-size class, with a price range that is hard to equal. Speeds for Carbides, Timken-Mounted Gear Shafts, Separate Lead and Feed Screws, and All-Geared Head adapt it to almost any job within its 16½″ swing.

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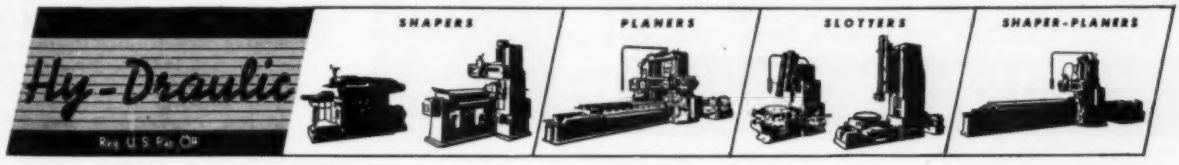

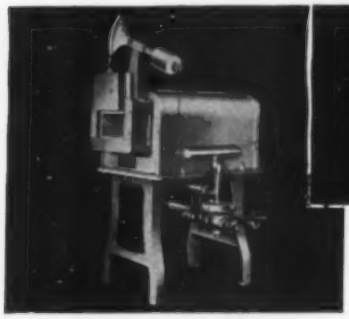

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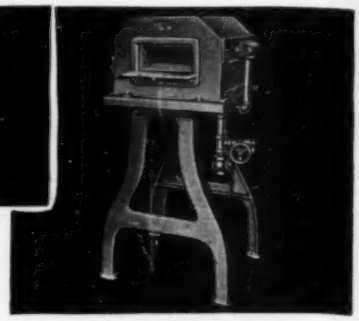

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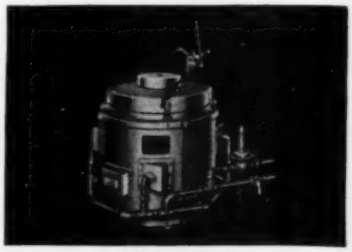

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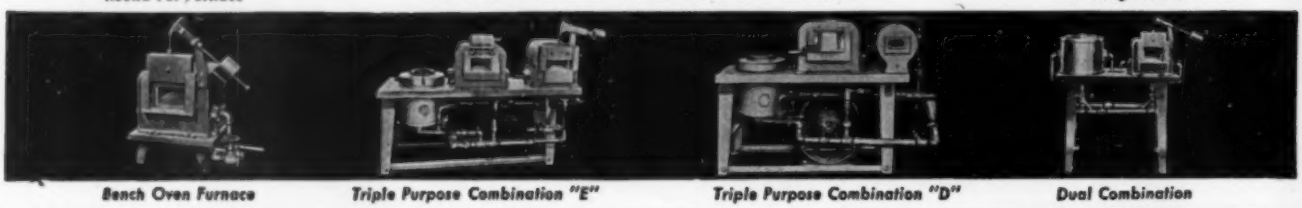

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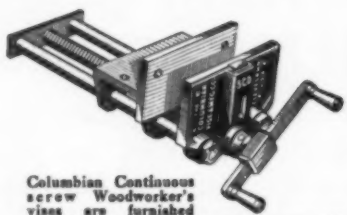
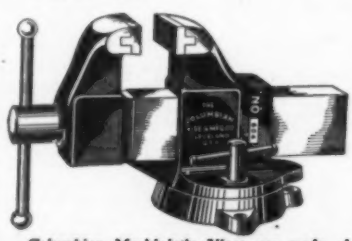


Columbian Continuous screw Woodworker's vises are furnished with hard wood handles — or may be equipped with ADJUSTABLE STEEL HANDLES, as above, to eliminate handle breakage, speed operation and provide extra leverage.



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"2 WOODWORKING FAVORITES"

IMMEDIATE SHIPMENT!

Hargrave Hand Screws and No. 640 "I" Bar Clamps are favorites of school shops and industrial users.

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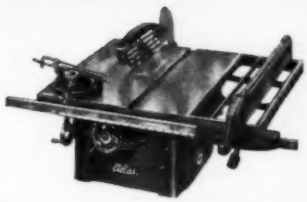
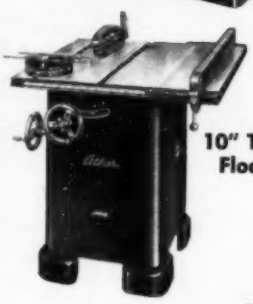
Atlas The NEW "Quality" Tools for School Woodworking Shops



8" - 10" Tilt/Arbor Bench Saws

24" Jig Saws



10" Tilt/Arbor Floor Saws

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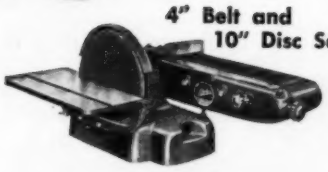
Free! — five wall charts listing decimal equivalents, cutting tool and thread information, etc. Invaluable teaching aids. Use coupon.



4" Belt and 10" Disc Sanders

12" Wood Lathes

Every vocational educator who has seen them has commented most enthusiastically about these new Atlas tools. It means that you, too, have a pleasant surprise in store — should see them at your earliest opportunity.

Most impressive to other vocational men have been (1) the immediately noticeable features of quality construction — the precision ground tables, the massive castings that provide extra stability for smooth operation and long wear, and the operating safeguards; (2) the many newly-engineered operating features that add to the capacity and versatility of the tools; (3) the careful precision workmanship on the tools that assures accurate operation, and the generous use of ball bearings to add smoothness and long service life. They have also been impressed that such good tools can be secured at low cost.

Your shop will be the showplace of the school with these big, new Atlas tools at the stations. And your students will undertake their courses with new enthusiasm for precise and careful workmanship with these Atlas tools to help them on their projects.

Your Atlas dealer will gladly arrange to show you all the new features of these tools, at your convenience. If there isn't a dealer in your city, send the coupon for new catalogs.

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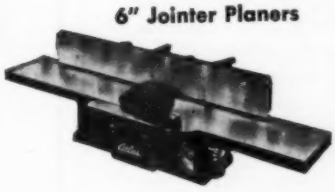

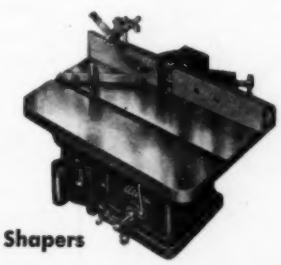

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Extra tough — for tough classroom service! Balanced taper ground polished blade. "Perfection" handle prevents wrist strain. Straight back, skip point. 20, 24 and 26-in. lengths. Rip and cut-off.

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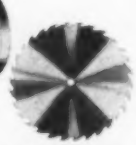
● **ATKINS NARROW BAND SAWS**
Tough, tempered yet flexible, with remarkable resistance to wear or breakage. In all standard widths.



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Made to stand up under hard usage of inexperienced students. For all types of machines, rip, cut-off, mitre or combination.

Teach the student the "feel" of a good saw and he'll be a better craftsman all his life. He'll learn faster and do better work right from the start. And hundreds of schools have proved that the best saws to accomplish this are those identified by the ATKINS "Silver Steel" Trade Mark. There are no finer saws — no saws that last longer with less servicing — no saws that cut easier or faster or are more economical for classroom use. From any point of view, the *right* saws for *your* school are ATKINS "Silver Steel" Saws. Make sure they are the ones you specify and get!

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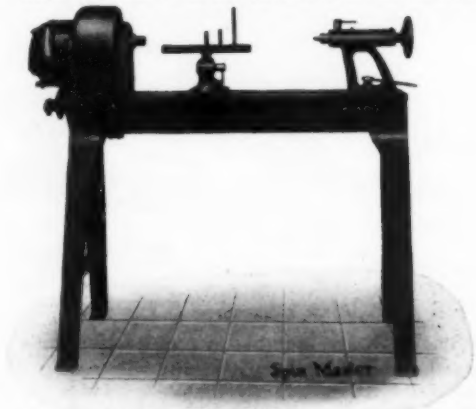
Spin Master

REG. U.S. PAT. OFF.

15 "METAL SPINNING LATHE"



- Spin Master Metal Spining Lathes are known in the trade to be the most substantial and the most productive causing least operator fatigue.
- They are also best for training purposes.
- The Model MS 15 shown above is not a converted wood turning lathe. It is engineered for fast production spinning. Available with floor or bench legs.

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TAKE A GOOD LOOK
at this Sjöström Shop Bench

There's only one practical way we know to let you see for yourself just how attractive, finely finished and well constructed these Sjöström Shop Benches are and that is to send you an *actual, unretouched photo* along with information on sizes, specifications and prices.

Therefore, if you will send us your name and address (a post card will do) we will send you your photo. We *know* you'll agree that these benches are *ideal* for school shops where long life and utility are important.

Sjöström Shop Benches are made in single or double types.

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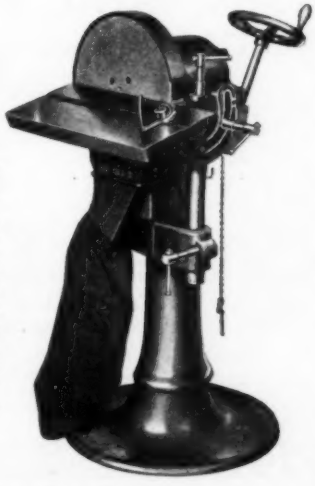
"OLIVER" 15-INCH Disk Sander

For smoother, more accurate work . . .



● You'll find this "Oliver" Sander will help your students do their finest work. The table tilts 45° down, 25° up. It is fitted with two gauges that enable you to sand angular and circular work smoothly without any fuss. This Sander can also be used for grinding and polishing light metals. *Write for Bulletin No. 182.*

"Oliver" makes a complete line of woodworking equipment for school shops.

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

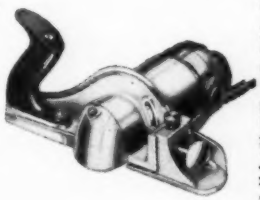
3 basic power tools that earn their budget-keep

These three tools belong at the top of your requisitions list. They're everyday, every-project tools and the most tool for the money. Write today for complete specifications, price, etc. Stanley Electric Tools, Educational Dept., 480 Myrtle St., New Britain, Conn.

Stanley No. 24A. ¼" Electric Drill.

Easy to handle, scaled down in weight and size for easy handling but not in quality of materials and workmanship. Widely used by aircraft and automotive shops. Surplus power for continuous drilling at full load in wood, metal and composition . . . ¼" in steel, ⅜" in wood. Jacobs 3-jaw chuck, aluminum alloy die cast housing, oil impregnated bronze bearings, helical gears, trigger switch with locking device, 3-wire rubber-covered cable. Drill stand available for making economical drill press.

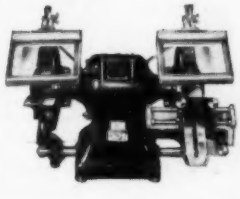
Stanley-Carter J3 Power Plane, ½ h.p.



This will be one of the busiest tools in your shop. Really two power tools in one. First, as a power plane, the spiral cutter at 18,000 r.p.m. leaves a smooth, waveless surface with or against the grain. Depth of cut set by adjustable front shoe. Then, by substituting Carter Shaper Cutters for the spiral cutter, the J3 becomes a versatile small planing mill. Makes surface beads, tongue and groove, rabbet, plow, chamfer, rounding over and other moulding cuts.

Stanley No. 677 Edge Tool Grinder, ⅓ h.p., 7" x 1" wheels

Operates at correct slow speed for edge tool grinding. Equipped with specially built wheels . . . one for edge tool grinding, the other, for general purpose grinding. "Flud-Lite" Eye Shields, adjustable to operator's position. Patented attachment for grinding plane irons up to 2-5/8" and any size chisels.



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HARDWARE • HAND TOOLS • ELECTRIC TOOLS • STEEL STRAPPING

EASIER teaching!
EASIER maintenance!

PORTER—CABLE
Speedmatic
PORTABLE SANDERS

SPECIALLY BALANCED

for easier handling and faster sanding!

The teaching day is long . . . maintenance work tiring. But here are sanders so nicely balanced that they make both your teaching and maintenance many times easier.

Students learn how to use these balanced sanders by the end of one or two class sessions. And you can do your maintenance sanding 10 times faster!

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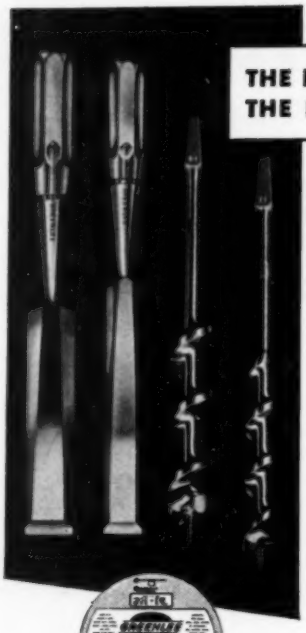

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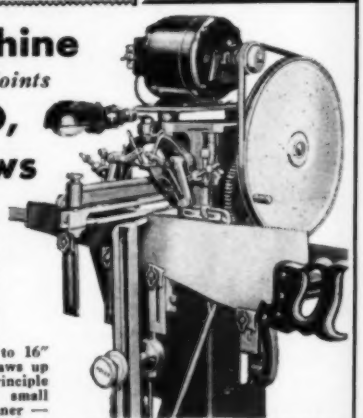

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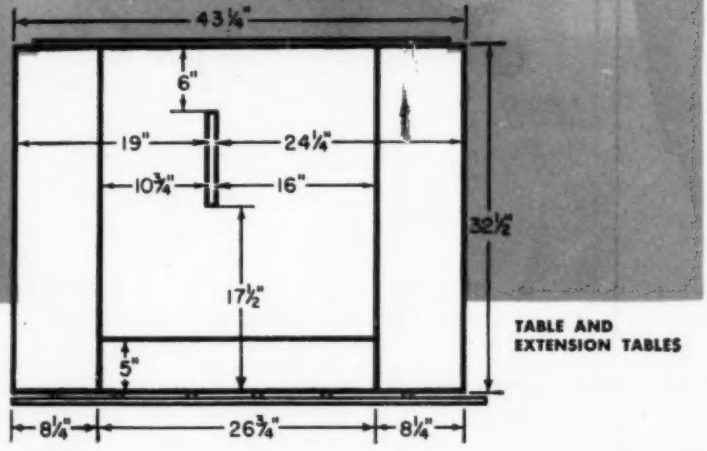

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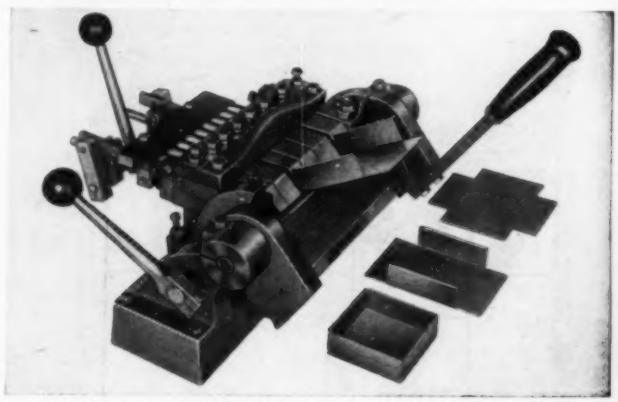

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The proceeds from this campaign help to pay for medical care and the special training that handicapped youngsters need to grow up to be useful, happy citizens.

Lend them a hand to overcome their handicap. Call the attention of your classes to this campaign. The sympathy of your students can be aroused easily so that more money will be available to carry on this fine and needful work.

This Month's Cover

The February INDUSTRIAL ARTS AND VOCATIONAL EDUCATION cover shows Thomas Ward, who has been a tool and die maker for 48 years, showing apprentice Donald J. Macon how to read a blueprint. Both work at the Fisher Body Die and Machine Plant, Detroit, Mich. Photograph, courtesy of Fisher Body Division, General Motors Corp., Detroit, Mich.

Coming Conventions

Feb. 12–15. Association for Supervision and Curriculum Development, at Denver, Colo. Secretary: Arno A. Bellack, 1201 — 16th St. N.W., Washington 6, D. C.

Feb. 23–25. Ohio Industrial Arts Association, at Columbus, Ohio. Headquarters, Deshler-Wallick Hotel. Secretary, Theodore Paige, Ohio University, Athens, Ohio.

Feb. 27–Mar. 2. Department of Audio-Visual Instruction (N.E.A.), at Atlantic City, N. J. Executive secretary, Vernon Dameron, 1201 — 16th St. N.W., Washington 6, D. C.

Mar. 9–11. North Carolina Vocational Association, meeting with North Carolina Education Association, at Raleigh, N. C.

Mar. 15–17. Mississippi Guidance Association, meeting with Mississippi Education Association, at Jackson, Miss. Secretary, Miss Eleanor Zeis, P. O. Box, 771, Jackson, Miss.

Mar. 16–18. American Society of Training Directors at Chicago, Ill. Headquarters, Palmer House. Exhibits in charge of H. K. Shore, Western Electric Co., Hawthorne Station, Chicago 23, Ill.

Mar. 16–18. New Jersey Vocational and Arts Association, at Asbury Park, N. J. Headquarters, Berkeley Carteret Hotel. President, Dr. Albert E. Jochen, 180 Amboy Ave., Metuchen, N. J.

Mar. 23–24. Alabama Vocational Association, at Birmingham, Ala. Convention chairman, J. E. Fortin, director, Alabama School of Trades, Gadsden, Ala.

Mar. 24. Tennessee Vocational Association, at Knoxville, Tenn. President, Frank F. Huffaker, 215 Chestnut St., Chattanooga, Tenn.

Mar. 24–25. Connecticut Industrial Arts Association, at New Britain, Conn. Headquarters, New Britain Teachers College. Convention chairman, Richard B. Smith, Bristol High School, Bristol, Conn.

Mar. 24–25. California Industrial Education Association, at San Francisco, Calif. Chairman, Harry M. Krytzen, Galileo High School, Van Ners and Francisco St., San Francisco, Calif.

Mar. 30–31. Industrial Arts Division of the Alabama Education Association, at Birmingham, Ala. President, S. A. Taylor, Sr., 5108 First Ave. N., Birmingham, Ala.

Mar. 30–April 1. Illinois Vocational Association, at Chicago, Ill. Headquarters, Congress Hotel. Convention chairman, Hobart H. Sommers, Board of Education, 228 N. La Salle St., Chicago 1, Ill.

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Industrial Arts and Vocational Education

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Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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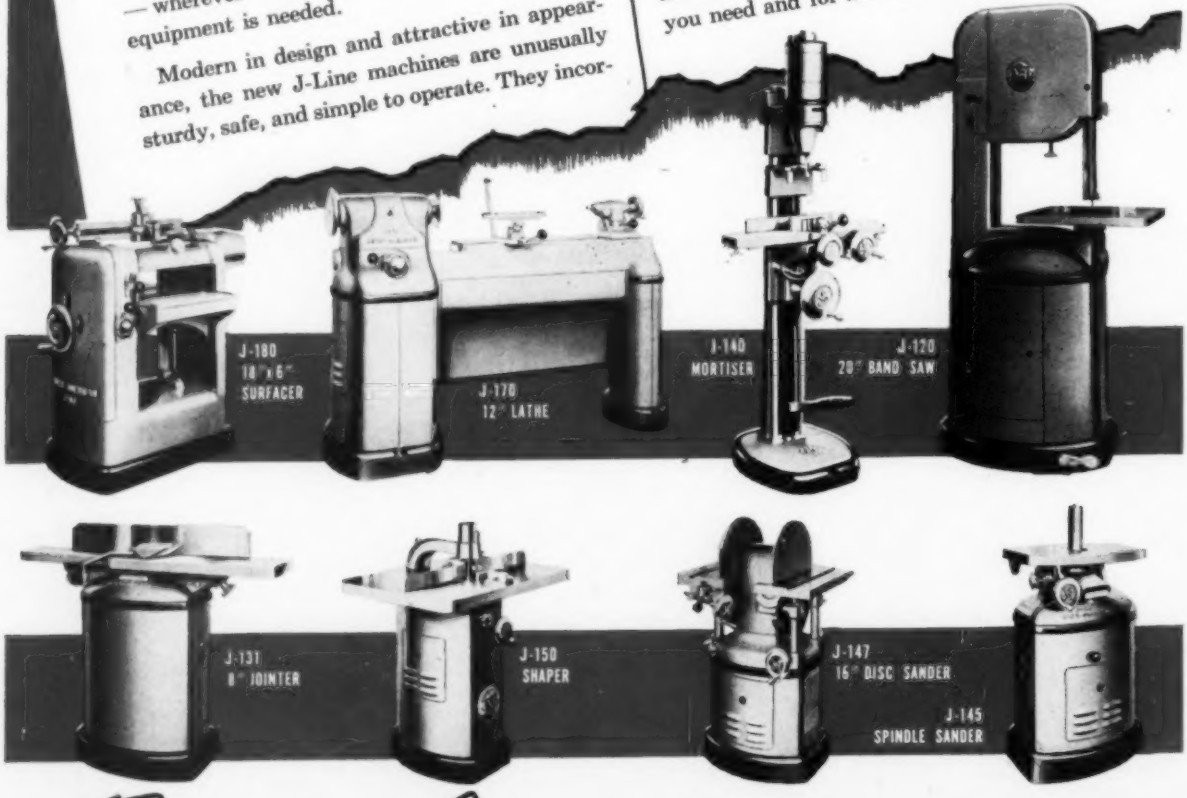

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FEBRUARY . . 1950

Grading Industrial-Arts Courses

LEON E. FALGREN
Industrial Arts Instructor
Northwest Junior High School
Kansas City, Kans.

Grades or marks are the usual means of indicating merit of schoolwork. In addition to indicating merit of work, the degree of presence or absence of certain character traits such as dependability, industry, faithfulness, carefulness, and neatness are frequently reflected in the grades or marks awarded. In most instances, the mark of merit awarded, becomes the basis for promotion, retardation, elimination, the award of honors, admission to higher institutions, graduation, recommendations for future positions, etc. In as much as marks are so widely used and that they vitally concern the receiver, it is not difficult to see why it is important that the reward should be valid and reliable. Until just a few years ago, no one questioned either the fairness or the validity of grades as a means of rating student achievement. It was assumed that marks were absolutely correct or very nearly so. In the academic field, it was nothing uncommon for the teacher to rate a student to the fractional part of a point even on the 100 per cent basis. Lately, scientific investigations have been conducted in the academic field, the results of which tend to prove that teachers' marks are not reliable; this being due largely to the subjectivity of the teacher's method of grading.

The experimental evidence showing unreliability of teacher's marks in the academic field, automatically raise the question of reliability of marks given by teachers of industrial arts. With this in mind, a study was made of the grading problem of industrial-arts teachers on the secondary school level. The purposes of the study were (1) to attempt to devise a means of eliminating, in so far as possible, some of the unreliability and subjectivity involved in present methods of marking, (2) to determine important factors to be used for basis for grades, and, (3) to suggest scales and profiles that may be used to make the grade a more objective rating of achievement.

In several publications, Rugg says that teachers' marks are variable and inconsistent, first, because teachers do not measure the same trait when grading or marking students; secondly, teachers do not use a common scale for the determination of certain amounts of the traits that are measured. Dr. Homer J. Smith, commenting on teachers' marks wrote, in a personal letter, that he felt that it would be a distinct help to the field of industrial arts, if some rather standard method of grading could be devised. He says that, in order to do this, it would seem necessary to establish main and subhead factors and then place weights for each. The following effort is an attempt to accomplish some such plan as suggested by Rugg and Smith.

Method of Collecting Traits Upon Which to Base Grades

Two methods have been used by the writer to collect traits or factors used by industrial-arts teachers, when rating merit of achievement:

1. Personally interviewing as many industrial-arts teachers as possible.

2. Incorporate these data in the form of an objective check list, and mail it to leaders in the field of industrial education. It was requested that they check the items that they thought should be used in determining merit of achievement in industrial-arts classes.

The technique followed in securing data is similar to that used by Charters & Whitley when they were making an analysis of secretarial duties.

Personal Interviews

The personal interviews were conducted with the idea of determining:

1. What factors were actually *used* by the instructors to rate merit of accomplishment in industrial-arts classes.

2. What scales, profiles, or methods were used to objectify the grading or rating of student achievement.

From the 76 men interviewed, a total of 77 factors were obtained which could, to some extent, be classified as different.

Most of the teachers interviewed, indicated that they used from 3 to 15 factors when grading student's work. Some admitted that they "lumped" or guessed at the grade and did not conscientiously consider any specific factors. A few used as high as 15 factors as a basis for grades and gave the interviewer an impression that "grading was one of the major objectives of the course." Several used as a basis for grades, the quality of the finished projects alone. The average number of factors used by the teachers interviewed was between five and six.

A very large percentage of these men used no objective means of determining grades; neither did they, in the majority of cases, use scales or profiles as an aid in objectifying the merit of student's accomplishment, nor was any system used whereby students had means of knowing how they ranked with the rest of the class. In view of the above, we may assume the ratings were little better than mere guesses. A reasonable safe estimate is that approximately 75 per cent of the men interviewed made little if any attempt to objectify the rating of student achievement.

Incorporating the Factors Into a Master Check List

The factors collected during the personal interviews, 77 in all, were incorporated into an objective check list or preliminary questionnaire, and was submitted to a jury consisting of 250 teachers of industrial arts with the request that they check such items as they thought should be used in establishing marks of merit. Replies were received from 145 individuals or in terms of percentage, approximately 58 per cent.

The returns from this preliminary check list were used in formulating the final questionnaire.

An attempt was made, in the final questionnaire, to eliminate duplication wherever possible. The final list was reduced to 38 different grading factors. These factors were then classified under the following headings:

1. Quantity of work accomplished
2. Quality of work
3. Effort put forth
4. Proper attitude
5. Knowledge acquired and applied
6. Ability to apply knowledge and skills.

The list as revised was submitted to the jury with the request that they check those factors which they actually used, and underline those factors which they considered as main factors.

Evaluation of Returns

Table I shows the composite reaction of 136 teachers, supervisors, and administrators of industrial arts.

With a few exceptions, which may be noted in Table I, the total rating of the factors seem to be in substantial agreement with the rating of those factors marked as "main factors" by the jury.

In view of the variation in the character

TABLE I. Industrial Arts Grading Factors Ranked by a Jury of Industrial-Arts Teachers, Supervisors, and Administrators

Total Rating			Main Factor Rating	
Rank	Total Votes	Factors	Total Votes	Rank
1	112	1. Cleanliness and neatness of work	35	13
2	103	2. Accomplishment in proportion to ability	73	1
2	103	3. Co-operation with fellow students and teacher	59	4
2	103	4. Ability to follow instruction, oral and written	52	6
3	99	5. Objective tests to check knowledge acquired	60	3
4	95	6. Attitude toward work, willingness to work	46	7
5	94	7. Initiative, self-direction, does own thinking	69	2
6	93	8. Dependability, honesty, does own work	44	9
6	93	9. Industry, never wasting time, drive	42	10
7	92	10. Ability to plan work. Make good job plan	56	5
8	89	11. Determination, perseverance, self-reliance	44	9
9	88	12. Accuracy in proportion to student's ability	60	3
10	86	13. Ability to read a working drawing	32	14
11	84	14. Quality of finished project, finish, design	45	8
11	84	15. Attitude toward equipment, care of tools	37	12
11	84	16. Completion of work. Finish any project started	31	15
12	83	17. Time factor. Speed of doing work	32	14
13	82	18. Extra work. Work accomplished over and above the required work of course of study.	25	19
14	78	19. Personnel duties performed by students	27	18
15	76	20. Deportment, conduct, behavior	32	14
15	76	21. Accomplishment based on average of class	44	9
16	75	22. Honest construction. Closely fitted joints	29	16
17	74	23. Artistic ability. Artistic workmanship	22	21
18	72	24. Oral recitation on related information	27	18
19	71	25. Attitude toward superiors, his teacher, etc.	17	24
20	67	26. Accuracy based on average of class	38	11
21	63	27. Safety factors, observation of	15	26
21	63	28. Attendance, absence, tardiness	10	28
22	61	29. Performance tests to check skills	25	19
23	60	30. Attitude toward finances	16	25
23	60	31. Student's shop personality, manners, speech	15	26
24	59	32. Determine type of construction for project	11	27
25	58	33. Service, improve service of shop	11	27
25	58	34. Ability to apply class information to situation outside	28	17
26	57	35. Subjective tests, essay type	23	20
27	56	36. Adapt outside information to classwork	18	23
28	49	37. Accuracy based on trade standards	21	22
29	46	38. Personal appearance, clean clothes, face, etc.	10	28

TABLE II. Knowledge Acquired and Applied

Total Votes	Factors	Major Factor Count
151	Ability to determine type of construction and plan work. Make a good job plan	67
114	Ability to make adaption of acquired information. (This is the combining of "Ability to apply class information" and "Ability to adapt outside information")	46
103	Ability to follow instructions (oral, written)	52
	Tests:	
99	*a*) Objective	60
61	*b*) Performance	25
57	*c*) Subjective	23
86	Ability to read a working drawing	32
72	Oral recitation	27
Total 743 or 25 per cent		332 or 25 per cent

Effort Put Forth and Desirable Habit Formation
(General Success Factors)

Total Votes	Factors	Major Factor Count
173	Determination, perseverance, self-reliance, completion of work, never give up attitude	76
94	Initiative, self-direction, does own thinking	42
93	Dependability, honesty, does own work	44
93	Industry, never wasting time, drive	42
63	Attendance, absence, tardiness	10
60	Shop personality, manners, speech, etc.	15
46	Personal appearance, clean clothes, hands, etc.	10
Total 622 or 22 per cent		266 or 20 per cent

Quality of Work
(Accuracy and Workmanship)

Total Votes	Factors	Major Factor Count
	Accuracy	
88	*a*) Proportion to ability	60
67	*b*) Based on average accuracy of class	38
49	*c*) Trade standards of accuracy	21
112	Cleanliness and neatness of work	35
84	Quality of the finished product	45
78	Personnel duties, quality of work while performing duties while tool foreman, lumber foreman, safety director, etc.	27

75	Honest construction of project	29
74	Artistic achievement (ability)	22
Total 627 or 21 per cent		277 or 22 per cent

Quantity of Work

Total Votes	*Factors*	*Major Factor Count*
	Accomplishment	
103	*a*) In proportion to ability	73
76	*b*) On the basis of average of the class	44
83	Time factor, speed in doing work	35
	Extra work	
78	*a*) Over and above the work required by the course of study	35
58	*b*) To improve the service of the shop	11
Total 398 or 14 per cent		185 or 15 per cent

Desirable Attitude

Total Votes	*Factors*	*Major Factor Count*
103	Co-operation with fellow students and teacher	59
95	Attitude toward work, willingness to work, thoughtful and careful	46
84	Attitude toward equipment, care of tools	37
76	Department, conduct	32
63	Observation of safety factors	15
71	Attitude toward superiors, teachers, principal	17
60	Attitude toward finances	16
Total 552 or 18 per cent		222 or 18 per cent

of subject matter and variations in conditions under which different units of industrial-arts subjects are taught, the question arose as to the possible variation in rating given the several factors by teachers of respective units and supervisors of industrial arts. After carefully checking the reaction of the jury, it seemed to have the same general trend in all of the units of industrial-arts work commonly taught in the public schools. This would seem to indicate that teachers in the various units of shopwork use approximately the same factors when grading student achievement. The major factor ratings by units of industrial arts respectively seem to have the same general trend of ranking as the total-factor ratings.

Having established the ranking of the factors through frequency rating, it seemed advisable to classify the factors under the following groups:

1. Knowledge acquired and applied
2. Effort put forth and desirable habit formation (general success factors)
3. Quality of work (accuracy and workmanship)
4. Desirable attitude
5. Quantity of work

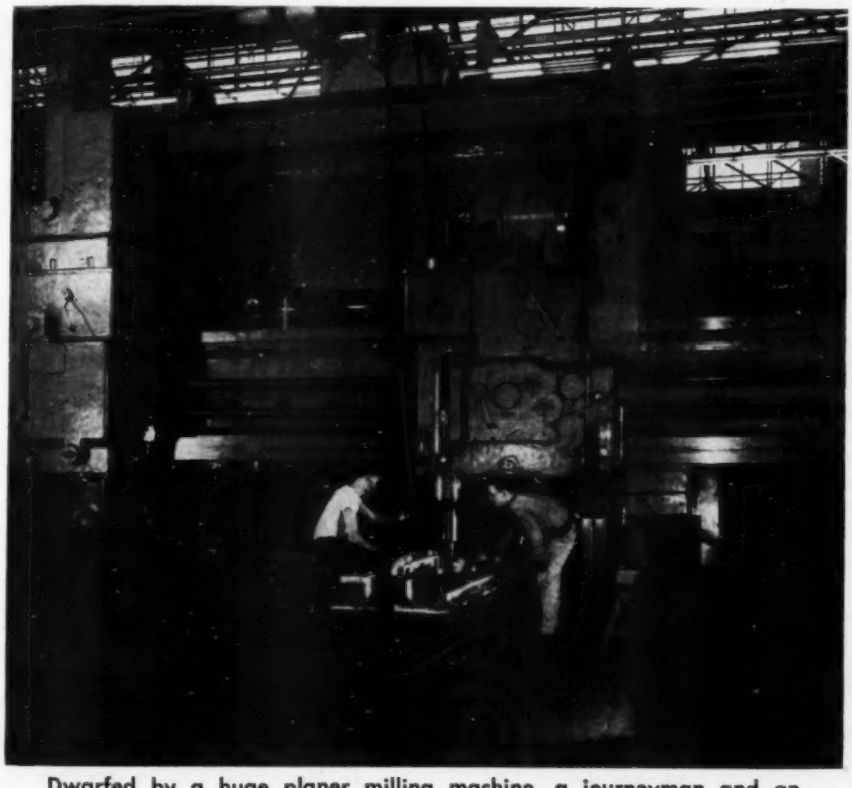
Examination of the several groups will show that all the factors appearing in the final questionnaire are included in one or other of these groups, either singly or in combination with factors which the jury reaction indicated were overlapping.

The resulting groupings are similar to those of the final questionnaire with exception of changes suggested by jury reactions.

In the first column on the left, in these classified groups shown in Table II, will be found the total votes given the various factors. The column on the right lists the major factor votes, those considered of primary importance by the jury. The total votes for each group will be found at the bottom of each group. Immediately following the totals is found the percentage of weight that each group should have according to the votes given by the jury.

To summarize, all of the factors were classified into five groups. After the votes were tabulated, following the reaction of the jury, it seems that: (1) knowledge acquired and applied should be given a weight of 25 per cent of the total grade; (2) effort put forth and desirable habit formation should be given a weight of 22 per cent of the total grade; (3) quality of work should receive a weight of 21 per cent; (4) desirable attitude should be given a weight of 18 per cent, and (5) quantity of work should be given a weight of 14 per cent of the total grade. Examination of the foregoing groupings will show that the percentage of the total votes and the percentage for major factor votes have approximately the same value for each group.

There will, perhaps, be some question as to the validity of these conclusions, and there are probably those who will question



Dwarfed by a huge planer milling machine, a journeyman and an apprentice work together at the Fisher Body stamping plant at Hamilton, Ohio. At the left is journeyman Louis Darovec who is teaching Thomas N. Tegge, a tool and die apprentice, the operation of the machine

— Fisher Body Division, General Motors Corp., Detroit, Mich.

the scientific status of the procedure. However, it seems to the writer that some plan would be better than no plan at all, and, in many cases, would be better than the plans used at the present time.

The Findings Applied to a Suggested Scale

The form of the suggested scale in Table III is very similar to the scale used in the industrial-arts department in the Norwood High School, Norwood, Ohio. The contents of the scale are based directly on the findings of this grading-factor study. The first column on the right lists the factors to be used, the second column lists the maximum points allowed for each factor. These points total 100. The third column provides a space for the teacher's rating of each of the factors, the fourth column provides space for another pupil's rating, and, the fifth column provides for the student to rate himself. To the writer, this seems to be a scale that most shop teachers might use to advantage. It is comprehensive, easy to administrate and should serve as a means of motivating the student to work to the best of his ability.

TABLE III. Rating Scale for Industrial-Arts Teachers

Name
Grade Graded by

Factors	*Maximum Points*	*Teacher's Score*	*Another Pupil's Score*	*Owner's Score*
I. Knowledge acquired and applied (25%)				
a) Ability to plan. Good job plan	5			
b) Ability to adapt acquired information	4			
c) Ability to follow instructions	4			
d) Tests — objective, performance, subjective	8			
e) Ability to read a working drawing	2			
f) Oral recitation	2			
II. Effort and desirable habit formation (22%)				
a) Determination, perseverance, etc.	7			
b) Initiative, self-direction	3			
c) Dependability, honesty	3			
d) Industry, never wasting time	3			
e) Attendance, tardiness	2			
f) Shop personality, manners, speech	2			
g) Personal appearance, clean clothes	2			
III. Quality of work (21%)				
a) Accuracy in proportion to ability	3			
b) Accuracy based on class average	2			
c) Accuracy, trade standards	1			
d) Cleanliness and neatness of work	4			
e) Quality of finished project	3			
f) Personnel duties	3			
g) Honest construction of project	3			
h) Artistic ability	2			
IV. Desirable attitude (18%)				
a) Co-operation with students and teacher	4			
b) Attitude toward work	3			
c) Attitude toward equipment	3			
d) Deportment, conduct	2			
e) Observation of safety factors	2			
f) Attitude toward superiors	2			
g) Attitude toward finances	2			
V. Quantity of work (14%)				
a) Accomplishment as to ability	4			
b) Accomplishment as to class average	2			
c) Time factor	3			
d) Extra work above course of study	3			
e) Extra work service of shop	2			

Testing and Tests

AIRCRAFT PROPELLERS TEST

WALTER M. GORDON
and
WILLIAM C. FORD
Aero Acres
Baltimore, Md.

General Directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it; proceed to the next questions and then to the next part. No questions will be answered after the examination begins. Are there any questions now? If not, begin.

Part I

Directions: Some of the following statements are true, and some are false. In each case write *T* on the left of the statement if you think it is true, or write *F* on the left if you think the statement is false.

( ) 1. A propeller has two motions, rotation and forward.
( ) 2. Most small aircraft propellers are of the fixed-pitch type.
( ) 3. The propeller of a "dead" engine is feathered in order to prevent windmilling.
( ) 4. Propellers are always located at the front end of an airplane.
( ) 5. An airplane engine and propeller are known as the power plant.
( ) 6. Adjustable-pitch propellers may have their blade-angle settings changed in flight.
( ) 7. All large aircraft use wooden-blade adjustable-pitch propellers.
( ) 8. Metal propeller blades are made of aluminum alloy or hollow steel.
( ) 9. The blade angle of controllable-pitch propellers may be adjusted in flight.
( ) 10. A constant speed propeller automatically maintains the engine at a fixed speed by means of a governor.
( ) 11. Fixed-pitch propellers are adjustable either in flight or on the ground.
( ) 12. The tendency of a revolving propeller blade to go to low pitch is called centrifugal twisting moment.
( ) 13. The tip and leading edge of wooden propellers are usually covered by metal.
( ) 14. Wood laminated propellers must be given several coats of varnish to keep out moisture.
( ) 15. Most small airplane propellers are so designed that they may be feathered if necessary.
( ) 16. When a propeller blade is feathered, the flat of the blade is parallel with the line of flight.
( ) 17. Adjustable and fixed-pitch propellers act as a brake when the airplane is in a power dive.
( ) 18. White lead and lard oil are put on the dome-retaining nut to keep out dust.
( ) 19. The purpose of a rear cone spacer is to properly locate the propeller on the shaft and, also, to prevent the front cone from bottoming.
( ) 20. In airplanes using a governor booster pump, the pump is usually located on the engine accessory section.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the blanks with the correct words or phrases necessary to complete each sentence.

1. The mechanism for controlling the blade angle of controllable pitch type propellers may be ....., ..., or .....
2. Brake horsepower is transformed into thrust horsepower by the .....
3. Fabric used on wood tips is for the purpose of .....
4. The track of a propeller may be checked by using a .....
5. The greatest stresses in a propeller are located .....
6. The two-position propeller control should be placed in ..... position when starting the engine.

7. The ..... valve prevents excessive pressure from forming in the governor of a hydromatic propeller.

8. The counterweight adjusting screws on a two-position propeller are used to.....

9. Copper is not very satisfactory for tipping wooden propellers because .....

10. Propeller blades are painted a flat red or black because .....

11. Node points on a propeller are the .....

12. A ..... propeller will not rotate in flight.

13. Reversing, or negative-pitch, propellers are usually used on .....

14. The propeller blade and the..... are similar in shape.

15. The basic function of an airplane propeller is to .....

16. Cuffs are installed on some airplane propellers for the purpose of ..... and .....

17. Propeller governor flyweights move ..... when engine speed is increased.

Part III

Directions: The meaning or association of the words in column 1, are to be found in column 2. In the space to the left of each number write the letter from column 2 which explains the meaning or association of that particular word or words.

Column 1

..... 1. blade root
..... 2. effective pitch
..... 3. fixed-pitch propeller
..... 4. electric controllable propeller
..... 5. adjustable pitch propeller
..... 6. underspeed
..... 7. governor booster pump
..... 8. blade plug
..... 9. micarta liner
..... 10. blade back

Column 2

a) manufactured in one piece
b) is located within the propeller governor
c) has a split hub
d) operated from airplane power supply
e) the portion of a propeller blade located in the hub
f) actual distance a propeller blade moves forward in one revolution in the air
g) indicates engine r.p.m. has increased
h) the curved side of a propeller blade
i) prevents grease from entering hollow blades
j) means that engine r.p.m. has decreased
k) eliminates galling of cylinder and piston when placed at base of propeller cylinder

Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrases following each sentence which will complete that sentence.

1. Small nicks are removed from aluminum alloy propeller blades by: (*a*) use of a milling machine; (*b*) fine cut file, emery cloth, and crocus cloth; (*c*) coarse file and sandpaper; (*d*) filing raised edges.

2. Manufacturers of wood propellers usually place the pitch setting data: (*a*) on the leading edge of the propeller; (*b*) on the propeller blade face; (*c*) on the propeller hub; (*d*) on the propeller boss.

3. Counterweight caps are installed: (*a*) hand tight; (*b*) slightly loose; (*c*) with some wrench pressure; (*d*) to a predetermined torque value.

4. The purpose or function of centering cones is to: (*a*) help balance the propeller; (*b*) align propeller on crankshaft; (*c*) prevent dirt from entering propeller hub; (*d*) secure propeller to crankshaft.

5. A full-feathered propeller, while the airplane is in flight, will: (*a*) continue rotating; (*b*) stop rotating; (*c*) increase r.p.m.; (*d*) make the propeller rotate faster.

6. The blade fillet is located: (*a*) on the blade tip; (*b*) midway between blade tip and shank; (*c*) on the blade shank; (*d*) near the blade shank.

7. The forces which act upon a propeller in flight are: (*a*) tension, thrust, and stress; (*b*) thrust, stress, and torsion; (*c*) thrust, centrifugal, and shear; (*d*) thrust, torsion, and centrifugal.

8. The proper way to balance wood propellers is to: (*a*) apply solder; (*b*) build up with plastic wood; (*c*) plane down the heavy blade; (*d*) place strip on trailing edge of blades.

9. Small nicks should be removed from steel blades by using: (*a*) sandpaper; (*b*) emery cloth; (*c*) grinder; (*d*) hand stoning.

10. When overhauling a propeller hub, the hub should be: (*a*) magnafluxed; (*b*) etched; (*c*) heat-treated; (*d*) electroplated.

KEY AND SUGGESTED SCORING

Part I

(1 point each)

1. T	5. T	9. T	13. T	17. T
2. T	6. F	10. T	14. T	18. F
3. F	7. F	11. F	15. F	19. T
4. F	8. T	12. T	16. T	20. F

Part II

(2 points each)

1. mechanical, electrical, hydraulic
2. propeller
3. protecting and strengthening the wood
4. surface gauge
5. at the hub
6. high pitch
7. by-pass relief
8. limit the range of travel
9. it is not resistant enough to wear
10. it keeps glare from the pilot's eyes
11. low point of vibration
12. full-feathered
13. seaplanes
14. airplane wing
15. pull the airplane through the air
16. cooling closely cowled engines, reducing drag on propeller blade shank
17. outward

Part III

(2 points each)

1. *e*	3. *a*	5. *c*	7. *b*	9. *k*
2. *f*	4. *d*	6. *j*	8. *i*	10. *h*

Part IV

(2 points each)

1. *b*	3. *a*	5. *b*	7. *d*	9. *d*
2. *d*	4. *b*	6. *c*	8. *a*	10. *a*

ARCHITECTURAL DRAWING TEST

WILLIAM H. BOWERS
High School
Tuckahoe, N. Y.

Directions: Of the following 100 statements, some are true, some false; if the statement is a true one place a *T* before it. If the statement is false place an *F* before it. No erasing allowed. If you have any questions, ask them now. No one is allowed to leave room after test is started. To ascertain your score subtract number wrong from 100%.

( ) 1. Architectural drawings are made to furnish instructions on how to build a desired structure.
( ) 2. The alphabet used on all architectural drawings in this school is of the English script type and at a 60-deg. angle.
( ) 3. Ornamental lettering is customary on all architectural drawings.
( ) 4. Guide lines are unnecessary as lettering aids, because it takes so much time to draw them.
( ) 5. On scales used for building plans an inch or a fraction of an inch represents one foot.
( ) 6. The parts of an inch employed on an architect's scale to represent one foot are as follows: 1/8 in., 3/16 in., 1/4 in., 3/8 in., 1/2 in., 3/4 in., 7/64 in., 5/32 in., and 1 in.
( ) 7. The trade experience of the mechanic enables him to assemble and connect the parts of a building.
( ) 8. The architect always consults the mechanic before drawing plans for a building and relies implicitly upon the mechanic's judgment.
( ) 9. Detailed information is furnished to the mechanic by means of small scale detail drawings.
( ) 10. Structures are classified according to the material from which they are built.
( ) 11. Brick and frame houses often differ only in their exterior walls.
( ) 12. It is customary for an architect to first submit a sketch to the owner of the building.
( ) 13. The general drawings of buildings are made by the architect.
( ) 14. Common practice, experience, experimental research, and building codes influence the draftsmen when making architectural drawings.
( ) 15. It isn't customary to comply with local building laws and codes.
( ) 16. The ideal preparation for an architectural draftsman is to serve a short apprenticeship in each of the building trades.
( ) 17. Foundations are built of stone, brick, or concrete because moisture in the ground causes wood to decay.
( ) 18. The bottom of the foundation is placed below the level to which frost penetrates.

( ) 19. When water changes to ice its substance decreases in volume.
( ) 20. If the ground should freeze under a foundation the whole structure would be lifted.
( ) 21. Most important structures have a minimum depth of 8 ft.
( ) 22. The width of the footing depends upon the tallness of the building.
( ) 23. All soils have the same sustaining power.
( ) 24. The walls are centered on the footings to obtain the best distribution of the load on the foundation bed.
( ) 25. Lumber is a term applied to the product secured from the rough log in the saw and planing mill.
( ) 26. Yard lumber is less than 6 in. thick and is used for general building purposes.
( ) 27. Shop or factory lumber is used for timbers.
( ) 28. Structural and factory lumber are used for the same purposes.
( ) 29. Oak and maple are used extensively for flooring.
( ) 30. Moldings and wainscoting are usually made of maple.
( ) 31. Lumber terms applied to lumber are not well defined.
( ) 32. The actual and nominal size of lumber is the same.
( ) 33. A 2 x 8-in. plank may be a floor beam, a rafter, or a stud.
( ) 34. Stock or standard sizes of lumber are available at most planing mills.
( ) 35. The standard lengths of lumber are multiples of three.
( ) 36. Manufactured lumber is classified as rough, surfaced, and worked lumber.
( ) 37. Surfaced lumber is always run through a planer.
( ) 38. The sill is built from 2 by 4-in. pieces on both light and heavy buildings.
( ) 39. The function of the sill is to distribute the load of the building over the foundation walls.
( ) 40. The sill is the direct support of the first floor beams and of the wall frame.
( ) 41. The studs used on a frame building are 2 by 8 in.
( ) 42. The corner posts are 4 by 6 in. for heavy buildings.
( ) 43. The studs are held in place by the plate.
( ) 44. The roof leads are transmitted to the frames of the plate.
( ) 45. The inclined members of a roof are called studs.
( ) 46. All members of the frame are securely screwed together.
( ) 47. Sheating is fastened to the inner sides of the studs.
( ) 48. The sheating boards are nailed diagonally across the studs.
( ) 49. Building paper is applied to serve as a heat insulator.
( ) 50. A layer of boards, which butt together, are nailed next, over the building paper.
( ) 51. Clapboards and shiplap boards cover the building paper.
( ) 52. A water table slopes from the building so that rain water will be shed away from the foundation wall.
( ) 53. Roofing boards are made out of 2 by 4-in. material, and are laid over the rafters.
( ) 54. The roof is completed after the roofing boards are fastened.
( ) 55. All windows and doors are made by the carpenter.
( ) 56. On framing elevations the studs are placed 18 in. on centers.
( ) 57. Wood laths are made 4 ft. long and will span three spaces.
( ) 58. It is customary to double the studs around doors and windows.
( ) 59. It is often required to show a rafter detailed, with all measurements and information concerning the cutting the rafter at its ends.
( ) 60. Doors and windows are always made to order and to different specifications.
( ) 61. The draftsman is required to make drawings for all doors and windows on a building.
( ) 62. A double-hung window has two sashes arranged to slide vertically in a frame.
( ) 63. The sashes are unbalanced so that they remain in any desired position.
( ) 64. The parts of a window frame to which the pulleys are attached are the pulley stiles.
( ) 65. Shingles may be made of wood or slate.
( ) 66. Roofs with steep slopes require a tighter covering than roofs with a slight slope.
( ) 67. If sheet metal is used as a covering on light slope roofs it is unnecessary to solder the joints.
( ) 68. Shingles are laid edge to edge on roofs.
( ) 69. The juncture where roof surfaces meet is made watertight by the use of strips of sheet metal called flashing.
( ) 70. Suitable stones are available in most all localities for foundation work.
( ) 71. Stones are laid as quarried, all projections being left on them.
( ) 72. All joints are filled with cement mortar.
( ) 73. Stones are laid to break joints, meaning the continuous vertical joints are avoided.
( ) 74. The term rubble masonry implies that the stones selected are of uniform size.
( ) 75. Common bricks are made of clay, molded to shape and *burnt* in a kiln.
( ) 76. The standard size brick is 2¼ by 4 by 8 in.
( ) 77. Bricks are also pressed, porous and hollow, depending upon the method of manufacture.
( ) 78. Face bricks are used where the bricks are visible on a building.
( ) 79. Terra cotta blocks are manufactured in the width of wall thicknesses.
( ) 80. Detail drawings are not made for ornamental panels and fireplaces.
( ) 81. Construction drawings must be made for simple brickwork, in addition to the general drawings.
( ) 82. The intersection of four sloping surfaces on a roof is called a *hip*, hence the name *hip roof*.
( ) 83. All building ordinances and codes must be complied with when erecting any building in New York State. The plans and specifications are supplementary.
( ) 84. The location and arrangement of stairs often determines the layout of the building.
( ) 85. The rise of a rafter is the vertical distance from the top of its plate to the intersection of the rafter lines.
( ) 86. The slope of the roof surface is stated on the drawing.
( ) 87. It is customary to draw all elevations to a full size on an architectural drawing.
( ) 88. The architect's scale is used only by architectural draftsmen.
( ) 89. Perspective drawing is used mostly by architectural draftsmen.
( ) 90. The style of alphabet is the same in architectural and machine drawing.
( ) 91. Both upper and lower case letters are frequently used by the architectural draftsman.
( ) 92. All material must be approved by the architect before it is used on a building.
( ) 93. It is necessary to draw several elevations when making house plans.
( ) 94. The "boss" of a building job, the man who has the last word, is the contractor.
( ) 95. Successful architects command high salaries.
( ) 96. An architect's work is tedious, confining, and monotonous.
( ) 97. It is customary to draw the elevations of a house to a scale of 6 in. = 1 ft.
( ) 98. It is customary to letter all *notes* on an architectural drawing by using upper case letters only.
( ) 99. It is necessary to have a basic foundation of mathematics to become an architect.
( ) 100. An extensive knowledge of art and design is a part of an architect's training.

KEY TO ARCHITECTURAL DRAWING TEST

1. T	7. T	13. F	19. F	25. T
2. F	8. F	14. T	20. T	26. T
3. F	9. F	15. F	21. F	27. F
4. F	10. T	16. T	22. F	28. F
5. T	11. T	17. T	23. F	29. T
6. F	12. T	18. T	24. T	30. F

31. T	45. F	59. T	73. T	87. F
32. F	46. F	60. F	74. F	88. F
33. T	47. F	61. F	75. T	89. T
34. T	48. T	62. T	76. F	90. T
35. F	49. T	63. F	77. T	91. T
36. T	50. F	64. T	78. T	92. T
37. T	51. T	65. T	79. T	93. T
38. F	52. T	66. F	80. F	94. F
39. T	53. F	67. F	81. F	95. T
40. T	54. F	68. F	82. T	96. F
41. F	55. F	69. T	83. T	97. F
42. T	56. F	70. F	84. T	98. F
43. T	57. T	71. F	85. T	99. T
44. T	58. T	72. T	86. T	100. T

AIRCRAFT CARBURETION TEST

WALTER M. GORDON
and
WILLIAM C. FORD
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Baltimore, Md.

General Directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it; proceed to the next questions and then to the next part. No questions will be answered after the examination begins. Are there any questions now? If not, begin.

Part I

Directions: Some of the following statements are true, and some are false. In each case write *T* on the left of the statement if you think it is true, or write *F* on the left if you think the statement is false.

( ) 1. The carburetor is essentially an atomizer.
( ) 2. When the mixture control is placed in the "Idle Cutoff" position the engine will stop regardless of the position of the throttle.
( ) 3. The venturi carburetor increases the air pressure as the speed of the air increases.
( ) 4. Icing of the carburetor may occur as a result of the rapid vaporization of fuel leaving the discharge nozzles.
( ) 5. The fuel to air ratio must always be 20 to 1 or more.
( ) 6. Too lean a mixture may cause engine overheating.
( ) 7. The float type carburetor is not suited for airplane maneuvering.
( ) 8. The pressure drop at the venturi throat is enough to make it a negative pressure.
( ) 9. The mixture ratio can be determined by making an analysis of the exhaust gases.
( ) 10. Detonation and preignition will cause inaccurate readings on the exhaust analysis.
( ) 11. Backfiring and kickback are identical.
( ) 12. Gasoline burns best in the cylinder when it is in a liquid state.
( ) 13. Consistently high induction air temperatures are to be avoided because of the increased danger of detonation.
( ) 14. At high altitudes the fuel mixture tends to become rich.
( ) 15. An automatic mixture control consists of a sealed bellows which responds to changes in pressure and temperature of the air entering the carburetor.
( ) 16. Impact tubes should be cleaned with pipe cleaners.
( ) 17. Carbon tetrachloride should be used to flush the diaphragm type carburetor.
( ) 18. The carburetor mixes air and fuel in the correct proportions by weight.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the blanks with the correct words or phrases necessary to complete each sentence.

1. Five distinct systems or sections of the carburetor are: ....., ..., ..., ..., and .....
2. Five factors the carburetor must be able to adjust for are: ....., ..., ..., ..., and .....
3. A ..... is used to aid the carburetor in maintaining the correct density of fuel and air mixture.
4. The amount of air entering the carburetor is controlled by the .....
5. An ..... is installed to increase the fuel supply in order to match the increase of air when the throttle is suddenly accelerated.
6. Generally speaking a ..... mixture should be used at high-power output, and a ..... mixture is desirable at a low cruising power.
7. If 10 parts of air to one part fuel were combined, the mixture would be .....
8. Icing of carburetor butterflies may be prevented by .....
9. Two advantages of the down draft carburetor over the up draft carburetor are: ..... and .....
10. An ..... is used in the induction system to distribute the charge to the cylinders of a radial engine.
11. Two ground adjustments made on the carburetor while the engine is operating are: ..... and .....

Part III

Directions: The meaning or association of the words in column 1 are to be found in column 2. In the space to the left of each number write the letter from column 2, which explains the meaning or association of that particular word or words.

Column 1

.... 1. discharge nozzle
.... 2. economizer
.... 3. 14.7 pounds per square inch
.... 4. excessively rich mixture
.... 5. automatic rich
.... 6. automatic lean
.... 7. full rich
.... 8. diffuser vanes

Column 2

a) air pressure at sea level
b) fuel pressure needed for operation of the carburetor
c) reduce high air velocity and increases its pressure
d) suitable for cruising under favorable conditions
e) provides richer mixture at full throttle and a leaner mixture at cruising speeds
f) loss of power, black smoke from exhaust
g) for emergency operation or when automatic mixture control is defective
h) sprays metered fuel into air stream
i) usual operating position, automatically maintaining desired fuel ratios at all throttle positions
j) loss of power, decrease cooling affects

Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrases following each sentence which will complete that sentence.

1. A correct mixture is indicated by a: (*a*) heavy black smoke; (*b*) short dark blue flame; (*c*) light black smoke; (*d*) yellow flame.
2. A rich mixture is indicated by a: (*a*) long yellow flame; (*b*) light black smoke; (*c*) black smoke and a dark red flame; (*d*) white smoke.
3. The unit in the carburetor which compensates for altitude is: (*a*) the economizer; (*b*) the mixture control; (*c*) the accelerating pump; (*d*) the priming pump.
4. The supercharger is used to: (*a*) maintain sea level density of carburetor air at varying altitudes; (*b*) decrease air flow in order to have a richer mixture at high altitudes; (*c*) increase air flow at varying altitudes in order to maintain the rich mixture; (*d*) to increase the flow of exhaust gases thus making room for an increased air supply at higher altitudes.

KEY AND SUGGESTED SCORING

Part I (*1 point each*)

1. T	5. F	9. T	13. T	17. F
2. T	6. T	10. T	14. T	18. T
3. F	7. T	11. F	15. T	
4. T	8. F	12. F	16. T	

Part II (*3 points each*)

1. main fuel metering, power enrichment, idling, accelerating, and mixture control
2. altitude, engine speed, engine load, air temperature, and air density
3. supercharger
4. throttle
5. accelerating pump
6. rich, lean
7. lean
8. heating induction air
9. reduced fire hazard, better distribution of vapor
10. impeller
11. idling speed and idling fuel

Part III (*1 point each*)

1. *h*	3. *a*	5. *i*	7. *g*
2. *e*	4. *f*	6. *d*	8. *c*

Part IV (*2 points each*)

1. *b*	2. *c*	3. *b*	4. *a*

TEST ON THE ELEMENTARY PRINCIPLES OF RADAR

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The United States Army Signal Corps at the Evans Signal Laboratory, Belmar, N. J., on January 10, 1946, opened up new possibilities to the secrets and mysteries of the universe by making radar contact with the moon. The scientists who were responsible for this Herculean task merit everyone's respect, admiration, and gratitude.

To have penetrated the ionosphere, the highly electrified layer above the earth's atmosphere, beyond which ordinary radio waves cannot go and which usually serves to deflect radio waves back to the earth's surface, is a new triumph in the progress of scientific knowledge. The accomplishment of reaching the moon by shooting electrical impulses a distance of 238,857 miles away and returning these pulses by radar promises fantastic new radionic wonders with sensational peacetime implications.

It is apparent that tremendous new scientific possibilities have been unfolded and there is further proof that our advancement in the field of radar is merely scratching the surface. The potentialities of radar are practically limitless. The new radar technique will provide an interesting tool in the exploration of the solar system. It opens the way toward the understanding of the cosmic rays which may carry the key to atomic power sources vastly greater than those which may now be extracted from the uranium nucleus.

Some day radar-controlled space ships may ply the void between the planets which thus far has been beyond the accomplishment of man. In this way radar may electrically gather and transmit important scientific data to the earth and finally radar may be the stepping-stone toward solving the age-old question — whether human life exists elsewhere besides on our own planet, the earth.

Objectives

1. To test the student's knowledge of the fundamental and elementary principles of radar.
2. To test the student's vocabulary and knowledge of the terms as applied to radar.
3. To discover the correlation which may exist between industrial arts and radar.
4. To find out how to adjust the content of the industrial-arts program to the new field of radar.
5. To find out how to vitalize the industrial-arts program by introducing selected material from the field of radar.
6. To capitalize upon the natural interests of the student and to encourage him to become more conscious of the underlying principles of radar.

Scoring the test: To get the total raw score for the complete test add the individual raw scores found at the ends of Parts I, II, III, IV, V, VI, and VII respectively.

General Directions: The aim of this test is to give you an opportunity to show what you have learned from your study of radar. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin.

Part I

Specific Directions to the Student: Some of the following statements are true and some are false. Read each statement carefully. If the statement is true, place a *T* in the parentheses before the statement, as in items 1, 2, and 4. If the statement is false, place an *F* in the parentheses, as in items 3 and 5. You will not be penalized for statements incorrectly marked.

Example:

(*T*) 1. Radar can measure the exact altitude above the earth of planes flying through storms at night.

(*T*) 2. During World War II the Japanese knew how to build radar controlled bombs.

(*F*) 3. During World War II small radar beacons were seldom planted near important targets in enemy territory by paratroopers and commandos.

(*T*) 4. The velocity with which an electromagnetic wave travels in any medium is given by the product of the wave length and the frequency.

(*F*) 5. The Army Signal Corps has demonstrated with certainty that low frequency radio waves can penetrate the ionosphere.

( ) 1. A short-wave receiver is a radio receiver especially designed for the reception of radio signals of low frequency.

( ) 2. During World War II radar directed the fire of bombers against unseen night fighters.

( ) 3. Airplanes in the stratosphere can release projectiles and steer them to their targets by radar.

( ) 4. When V-E Day arrived Germany's radar and fire-control apparatus was more efficient than that of the United States.

( ) 5. Rādar is the most versatile weapon of modern warfare.

( ) 6. The ability to use television has come largely since 1935.

( ) 7. Several types of radar antennas are used in broadcasting.

( ) 8. During World War II the Navy "ASV" surface-search equipment was used to brilliant advantage to track down submarines.

( ) 9. The radio controlled bombs used in Europe during World War II were 20,000 pounders.

( ) 10. Like radio, radar begins with the flow of electrons from the plate to the filament of a vacuum tube.

( ) 11. In World War II radar equipment revolutionized the United States surface operations both in combat and in reconnaissance.

( ) 12. Gamma rays are more powerful than Alpha or Beta rays.

( ) 13. When the radar pulses leave the magnetron they are flashed to the antenna to be sent out into space.

( ) 14. Electrical conducting surfaces have a large portion of free protons.

( ) 15. The watt is the unit of impedance.

( ) 16. Cosmic rays pass easily through 14 ft. of lead.

( ) 17. Alpha rays are able to travel from 1 to 4 ft. in air before their force is spent.

( ) 18. Loran is a form of high frequency radar.

( ) 19. In July, 1944, the Fifteenth Air Force of the United States leveled the Ploesti Oil Refineries by means of "Mickey."

( ) 20. The Luftwaffe of Germany during World War II employed air-borne radar more widely than the Allies.

( ) 21. A condenser is a device consisting of two parallel contacting metal plates.

( ) 22. Scientists have discovered that conditions for the study of cosmic rays are better at ground level than in the thin air of high altitudes.

( ) 23. The unit of capacitance is the farad.

( ) 24. A missile can ride a radio beam for a great distance.

( ) 25. The type of "window" used by the Allies during World War II was black.

( ) 26. The time it takes the waves to go from the transmitter of a radar antenna to a distant object and back to the cathode tube is measurable.

( ) 27. The Japanese contributed a great deal to the early development of ultra-high frequency equipment needed for radar.

( ) 28. Cathode rays produce X-rays when suddenly stopped by solid objects.

( ) 29. The United States armed forces had radar fire control during World War II.

( ) 30. Surrounded by vigilant sonobuoys submarines can move without disclosing their position and direction of movement.

( ) 31. Scientists look confidently ahead to vast explorations in solar space with radar.

( ) 32. Mars has too thick an atmosphere envelope to admit passage of radar signals even if sufficient power were generated to span the 30,000,000 miles.

( ) 33. High frequency radio waves can successfully penetrate the gaseous, electrically charged ionosphere that bands the earth and stratosphere.

( ) 34. The rebounding of low and medium frequency radio waves from the lower stratosphere is what makes long distance broadcasting possible on earth.

( ) 35. The second layer of the ionosphere

is approximately fifty miles from the earth's surface.

( ) 36. Engineers and astronomers agree that radio rockets to the moon are a distinct probability.

( ) 37. Radar technique will aid scientists in the study of meteoric material in the vicinity of the earth.

( ) 38. The skip zone interferes very little with present-day radio communication.

( ) 39. The vacuum tube controls the timing of the entire radar set.

( ) 40. The frequency of wireless telegraphy waves is over a billion times that of light waves.

Scoring Part I: Raw score or total number of questions answered correctly. .....

Part II

Specific directions to the Student: The following statements are false and have been falsified by the insertion of one incorrect word instead of a correct word. Underline the word in each statement which makes the statement incorrect. Letter neatly the correct word in the blank space immediately following the statement.

Example:

1. The angle or arc which may be used, and observed, together with the altitude to describe completely the position of an object in the sky at a certain time, and seen from a certain place is called the *klystron*. *Asimuth*

2. Calculations for contact with the moon were perfected as early as 1942 by a group of scientists working on the radar project at the *Illinois* Institute of Technology. *Massachusetts*

1. An airplane pilot is given his bearing for finding his position by a radar short-range navigation beam. .....

2. During World War II the United States had a series of bombs carrying television gear which were released from a parent plane flying at low altitude. .....

3. The United States Army Signal Corps scientists achieved their first contact with the moon, 238,057 miles away, on January 10, 1946, the pulses completing the round trip in about four and a half seconds. .....

4. A piece of iron magnetized by a current flowing in a coil wound about it is called an electrolyte. .....

5. While transmitting pulses, the radar antenna makes anywhere from one to twenty or thirty revolutions a second. .....

6. The heart of radar is a cathode-ray tube shaped like a trumpet through which protons are shot. .....

7. In June, 1944, when Germany began launching flying bombs these bombs were steered by a radio compass. .....

8. By timing the return of radar impulses from the moon scientists may be able to improve their estimate of the speed of sound. .....

9. The two plates of a condenser, when connected to a source of electromotive force or to any two points in an electric circuit, become charged with comparatively large amounts of the same kinds of electricity. .....

10. The application of radar in World War II found particular use in the Pacific in the LAB or high altitude bombsight. .....

11. During World War II both the Allied and Axis planes used effectively "window" strips of paper backed lead foil. .....

12. Scientists claim that the most practical use of the Army's moon-reaching radar would be to explore the mysterious electrically charged blanket around the earth called the stratosphere. .....

13. An echo that has returned to the antenna and has been applied as a positive electrical charge to the cathode-ray grid causes a very bright point of light along the pip. .....

14. During World War II antiaircraft guns used radar controlled proximity robot shells. .....

15. Henrich Hertz was the first to measure electromagnetic or Hertzian waves named in his honor and to determine the length of propagation.

Scoring Part II: Raw score or total number of questions answered correctly. .....

Part III

Specific Directions to the Student: Answer each of the following questions with a single word or number. Letter neatly the answer in the blank space to the right of the question.

Example:

1. What is the third vacuum-tube element called, which is placed between the filament and the plate? *grid*

2. What is the unit of resistance in electricity called? *ohm*

1. What device did the British physicists bring with them in the fall of 1940 which was considered the most efficient high-powered generator of microwaves ever found and which was destined to become the most important single contribution to radar technique? .....

2. Besides an open ring what is the best form for the coil of an electromagnet? .....

3. What is the blanket called which envelops the earth in electrically charged layers beginning about thirty-eight miles above the earth's surface? .....

4. What is the last name of the professor of electrical engineering at Columbia University who has numerous important basic radio patents to his credit? .....

5. What is the speed of light in miles per second? .....

6. What is the Greek name for amber? .....

7. What is the name of the radar screen called which is specially designed to record the moon echoes visually? .....

8. What is the name of the tube which was abandoned in favor of the magnatron due to the intricacy of its design and the technical difficulties in pulsing it? .....

9. What is the angle or arc called which is measured along the horizon, from the south through the west, to that point directly underneath the object? .....

10. What are the mysterious rays or packets of energy called which come from the sun or the depths of the universe? .....

11. What is the three letter word for the bombsight which operates at one thousand feet or less and can see farther in the daytime than the human eye? .....

12. What is a conductor of high resistance called which permits electrons collecting on the grid of an electronic tube to flow back to the filament? .....

13. What is the new term used in radar to indicate long-range aid to navigation? .....

14. What is a dynamo or electric machine called for converting the mechanical energy of a prime mover into electrical energy? .....

15. What is the unit of electromotive force called? .....

Scoring Part III: Raw score or total number of questions answered correctly. .....

Part IV

Specific Directions to the Student: Each of the following sentences defines one of the words shown at the end of Part IV of this test. Make the proper connections by lettering neatly the number preceding the sentence in front of the word at the end of Part IV with which it should be associated.

Example:

1. The multi-layered upper atmosphere is composed of at least four layers and carries electrical charges of varying lengths. The lower layer begins approximately 38 miles above the surface of the earth.

2. A glowing beam lying across the center of the screen; also known as a time base. It is synchronized with the radar antenna as it scans.

3. The transmission of images to distant stations by electrical means, almost simultaneously with their occurrence.

4. The electrical unit of resistance.

5. A device consisting of two parallel metal plates separated by air or other insulating substance.

..5.. condenser	..... pip
..... joule	..2.. sweep
..... stratosphere	..1.. ionosphere
..4.. volt	..... radio
..... grid	..3.. television

1. A tiny radio broadcasting station which could be dropped during World War II by parachute in the vicinity of a place where a patrol plane spotted a U-boat.

2. A flower-shaped antenna that is set up on a life raft to throw back the pulses from transmitters of search planes to guide rescuers directly to the scene of distress.

3. Radar equipment carried by a meteorological balloon.

4. An area in which the radio signals of a certain transmitter are not heard due to the signals striking the ionosphere at an angle too oblique to penetrate it.

5. This device is similar to television's cathode-ray tube and translates the returning pulses into visual readings of the distance and direction of targets.

6. A network of conductors placed at some distance from the ground and used as a radiator of electromagnetic power.

7. A strange form of radar antenna.

8. Due to the change of solar energy this part of the ionosphere disappears at night.

9. A radio sending and receiving station in the nose of a projectile which played an important role in land warfare, particularly during the German counteroffensive in December, 1944, the so-called battle of the bulge.

10. The "potato masher" for jamming enemy radar.

11. A radar bombsight.

12. The layer of the ionosphere which is about 75 miles above the surface of earth.

13. Something which appears on the radar screen of an oscilloscope when the pulses return to the radar transmitting station.

14. The ratio of an electrical charge carried by an isolated conductor or condenser to the resulting potential.

15. That property of a circuit which opposes the flow of current and is the combined effect of resistance and reactance.

..... antenna	..... ionization
..... bell buoy	..... Mickey
..... blip	..... oscillator
..... capacitance	..... oscilloscope
..... dipole	..... pip
..... corner reflector	..... proximity fuse
..... direction finder	..... punch
..... D-layer	..... radiosonde
..... E-layer	..... radome
..... F1-layer	..... reactance
..... F2-layer	..... skip zone
..... frequency	..... sonobuoy
..... gas buoy	..... sparbuoy
..... impedance	..... spectroscope
..... inductance	..... spinthariscope
..... intermediate	

Scoring Part IV: Raw score or total number of questions answered correctly. .....

Part V

Specific Directions to the Student: The following questions can be answered by a single word. Complete each statement by lettering neatly the missing word in each blank space. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example:

1. Signal Corps scientists say that the first practical result of the United States Army's radar contact with the moon is likely to be improvement of ...*radio*... communications.

2. The equipment used by the United States Army scientists to reach the moon was invented and built by Major Edwin H. ...*Armstrong*....

3. During World War II, Germany's V-2 rocket weapon reached an altitude of sixty miles, far above the lower ...*ionosphere*....

1. Cathode rays are streams of high velocity .....

2. The Navy has been especially interested in microwave .....

3. Reflected pulses create a distinctive pattern on the .....

4. Russia is experimenting on the secret of the cosmic rays at laboratories constructed in the mountains of Soviet .....

5. When the ionosphere is fully charted, vast improvements in many forms of radio communication will be possible, particularly in the elimination of the so-called ..... zone.

6. Unless relay systems or networks are developed, television transmissions are limited roughly to ..... miles.

7. Cathode rays may be produced by passing an electrical discharge through a partially evacuated chamber or by heating a filament in a .....

8. In 1938 the United States Navy after 16 years of preparatory experiment sent to sea ..... radar sets.

9. The direction or bearing of a located object is revealed by the direction in which the radar ..... is aimed.

10. An antenna twice normal size was mounted on a one hundred foot tower at the Evans laboratory and aimed at the moon by means of a special ..... sight.

11. When the radar impulses reflected from the moon were recorded at the United States Army's New Jersey experiment station on January 10, 1946, it proved what scientists had long suspected — that ultra-..... radio waves could penetrate the ionosphere.

12. If there are any radar receiving stations on other heavenly bodies to receive messages, ours would have to be tuned to the same ..... as their transmitting sets.

13. Radar was devised secretly in the middle nineteen .....

14. During World War II the British were farther advanced than other nations in the development of what they called .....-location.

15. On the radar screen at the Evans laboratory as each pulse returned from the moon a new and smaller ..... appeared.

Scoring Part V: Raw score or total number of blank spaces correctly filled.

Part VI

Specific Directions: The following questions can be answered by a single word or name. Complete each statement by lettering neatly the missing word or name in each blank space. The missing words or names may be found in the list of words or names at the end of Part VI of this test. Do not use the same word or name more than once. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example:

1. Ground search radar units have been adapted for purposes of weather observation; a pilot balloon is followed by radar through cloud ceilings and measured for speed and distance on the ...*oscilloscope*....

2. The unit of quantity of electricity is called the ...*coulomb*....

3. Sperry holds basic patents on the ...*klystron*....

4. When a piece of magnetic material is brought near to a magnet or placed in a magnetic field, it is temporarily magnetized by ...*induction*....

conduction	ohm
coulomb	oscilloscope
cyclotron	volt
induction	radiation
klystron	

1. The first indications of the existence of radioactivity were obtained in 1896 by .....

2. The term used to designate the electrode by which electricity leaves a solution in an electric cell is called the .....

3. United States Army Signal Corps engineers were successful in transmitting radio pulses of extremely high frequency and energy against the moon and caught them on the rebound at the speed of light on instruments at the Evans Signal Laboratory, ..., New Jersey.

4. The rolls of long foil streamers that were used later in World War II to clutter up Japanese radars were known as .....

5. A vacuum tube may be considered a master .....

6. The number of complete cycles through which an alternating current passes in one second is called .....

7. Mars is 35,000,000 miles beyond the earth in the solar system. The radar round trip to Mars would, therefore, take approximately ..... and one quarter minutes.

8. During World War II it was possible to make an electric "window" in the enemy scope by electronic .....

9. The slightly curved face of a cathode tube, painted on the inside with a fluorescent material is called a .....

10. The foundation upon which the modern science of radio communication has been built is attributed to the work of Hertz and .....

11. The AAF and navy planes of World War II which carried special equipment and used to send out signals that would cover up the enemy's radar signals were known as .....

12. In World War II if a radar operator was in friendly territory he had to send out his ..... signal.

13. The value of impedance is given by the equation $Z = \sqrt{R^2 + X^2}$ where Z is the impedance, R the resistance, and X the .....

14. The klystron was invented by the ..... brothers.

15. Beta rays are capable of penetrating through a few ..... of aluminum.

ASV	ionization
anode	jamming
Becquerel	LAB
Belmar	Maxwell
capacitance	Meitner
cathode	Meters
centimeters	millimeters
Chadwick	oscillator
Clifton	radioactivity
eight	reactance
ferrets	rope
five	screen
frequency	seven
ground	six
Hoboken	spectroscope
IFF	spinthariscope
inductance	varian

Scoring Part VI: Raw score or total number of blank spaces correctly filled. .....

Part VII

Specific Directions to the Student: Each of the following statements can be correctly completed by the use of one of the words contained within the parentheses. Underline the correct word in each sentence.

Example:

1. Radar types are broadly classified in (two, three, four, five) categories.

2. The unit of electrical current is the (volt, ampere, watt, farad).

1. The German "window," good only against microwave radar, was dull (white, silver, black, gold).

2. The Western Electric Company's yearly output reached a record high in 1944 of (twenty, thirty, forty, fifty) two thousand.

3. During World War II as the radar controlled bombs approached the ground its television set relayed to the plane a picture of the ground and an engineer guided the projectile by radar during the last (one, two, three, four) thousand yards of its flight.

4. To carry on research and development work in radar during World War II the National Defense Research Committee set up the Radiation Laboratories at the (Illinois, Northwestern, Armour, Massachusetts) Institute of Technology.

5. Beta rays are negatively charged electrons emitted with tremendous velocities ranging up to (.0009, .009, .09, .9) that of light.

6. A radar system generates high-frequency waves which are reflected from an antenna and picked up when reflected back from objects in its range and converted into a pattern on a (fluorescent, gold, silver, white) screen.

7. Radar consists of a transmitter capable of projecting into space pulses of high-frequency energy several times as powerful as the output of the largest radio broadcasting system; a receiver directly alongside of the transmitter, capable of detecting returning echoes that are a (hundredth, thousandth, millionth, billionth) part of this energy.

8. Bell Laboratories has made important contributions in the realm of directional antennas employed in high-frequency transmission outstanding of which is the (rectangular, rhombic, round, square).

9. Reflected pulses create a distinctive pattern on the (interphone, flak, scope, spectrum).

10. The radiating member of an important air-borne radio antenna is a T-shaped dipole assembly of metal and plastics which projects stamenlike from the heart of a (parabolic, oscillating, klystron, dielectic) reflector.

11. Radio communication was given its first great impetus by (Armstrong, Becquerel, deForest, Varian)'s audion tube.

12. A great deal of the recent radar equipment brought into use since 1942 is of the (electromagnetic, fluorescent, microwave, longwave) type.

13. The difference between the electromagnetic waves of light and the electromagnetic waves used in radar communication lies in the (frequency, interpolation, radioactivity, reactance) of the vibration.

14. To keep the huge outgoing pulse from smashing into the receiving circuits and the faint incoming pulse from being lost in the transimtter circuit, an almost complete insulation of the two circuits is provided by a (Loran, LAB, M-9, T.R.).

15. A land based radar may tip the scales at (seventy, eighty, ninety, one hundred) thousand pounds.

Key — Part I

1. F	9. F	17. F	25. F	33. T
2. T	10. F	18. F	26. T	34. F
3. T	11. T	19. T	27. T	35. F
4. F	12. F	20. F	28. T	36. T
5. T	13. T	21. F	29. T	37. T
6. F	14. F	22. F	30. F	38. F
7. T	15. F	23. T	31. T	39. T
8. T	16. T	24. T	32. F	40. F

Key — Part II

1. (short) should be long
2. (low) should be high
3. (four) should be two
4. (electrolyte) should be electromagnet
5. (second) should be minute
6. (protons) should be electrons
7. (radio) should be magnetic
8. (sound) should be light
9. (same) should be opposite
10. (high) should be low
11. (lead) should be tin
12. (stratosphere) should be ionosphere
13. (pip) should be sweep
14. (robot) should be fuse
15. (length) should be velocity

Key — Part III

1. magnatron	9. azimuth
2. horseshoe	10. cosmic
3. ionosphere	11. LAB
4. Armstrong	12. grid-leak
5. 186,000	13. Loran
6. electron	14. generator
7. oscilloscope	15. volt
8. klystron	

Key — Part IV

1. sonobuoy	9. proximity fuse
2. corner reflector	10. radome
3. radiosonde	11. Mickey
4. skip zone	12. E-layer
5. oscilloscope	13. pip
6. antenna	14. capacitance
7. dipole	15. impedance
8. D-layer	

Key — Part V

1. electrons	9. antenna
2. radar	10. peep
3. scope	11. short
4. Georgia	12. frequency
5. skip	13. thirties
6. fifty	14. radio
7. vacuum	15. pip
8. two	

Key — Part VI

1. Becquerel	9. screen
2. cathode	10. Maxwell
3. Belmar	11. ferrets
4. rope	12. IFF
5. oscillator	13. reactance
6. frequency	14. Varian
7. six	15. millimeters
8. jamming	

Key — Part VII

1. black	9. scope
2. twenty	10. parabolic
3. two	11. deForest
4. Massachusetts	12. microwave
5. .9	13. frequency
6. fluorescent	14. T.R.
7. billionth	15. seventy
8. rhombic	

TRUE-FALSE EXERCISE ON FASTENINGS

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Directions: Read each statement carefully before you mark your answer. Some of the statements are true, some of the statements are false. If you think a statement is true, encircle the letter *T*. If you think a statement is false, encircle the letter *F. Do not guess.*

Example: (T) F Mechanical drawing is the language of industry.

T F 1. A machine structure, usually made up of parts, is held together as a unit by certain devices known as fasteners.

T F 2. Fasteners such as bolts, screws, keys, etc., are referred to as movable fasteners.

T F 3. Fasteners such as rivets, welds, shrink fits, etc., are referred to as temporary fasteners.

T F 4. A space curve generated around and along the surface of a cylinder by a point moving uniformly in both directions is known as a helix.

T F 5. The helix is the foundation of all screw threads.

T F 6. A smooth helical curve may be drawn by dividing the circle and the pitch into as many equal parts as are necessary.

T F 7. The development of a screw thread or helix is in the form of an isosceles triangle.

T F 8. The long base of the triangle is equal to the amount that the screw will travel in one revolution, that is the circumference of the screw.

T F 9. The short leg of the triangle is equal to the amount that the screw advances in one revolution, or the pitch of the screw.

T F 10. The hypotenuse of the triangle represents the exact curve of the screw thread commonly known as the spiral.

T F 11. In drawing a single threaded screw, it is important that the crest points are opposite each other.

T F 12. When a thread is cut on the outer surface of a fastener, it is an internal thread.

T F 13. The outside of a screw thread is usually referred to as the minor diameter.

T F 14. The root diameter of a screw thread is generally referred to as the effective diameter.

T F 15. The distance from the crest of one thread to the corresponding crest of the adjacent thread measured parallel to the axis of the threaded piece is equal to the pitch.

T F 16. The rule for finding the pitch of a screw thread is one divided by the lead of the thread.

T F 17. When a screw thread is formed on the inner surface of a fastener, it is referred to as an internal thread.

T F 18. The distance a screw thread advances parallel to the axis in one complete turn is called the lead.

T F 19. A single thread is one in which the lead is equal to the circumference of the thread.

T F 20. A double thread is one in which the pitch is equal to the lead.

T F 21. The top surface which joins the two sides of the thread is called the crest of the thread.

T F 22. The bottom surface which joins the sides of two adjacent threads is referred to as the thread angle.

T F 23. The surface connecting the crest and root of a thread is the side of the thread.

T F 24. The distance between the crest and the root of the thread measured parallel to the axis is called the depth of the thread.

T F 25. A thread whose crests and roots are not flattened and whose thread angle is 60 deg. is known as a Sharp-V thread.

T F 26. The Sharp-V thread is used on high precision instruments and to increase the holding power of setscrews.

T F 27. The Sharp-V thread has been approved by the American Standard Association.

T F 28. Our national screw thread system is comprised of five thread series.

T F 29. The British standard thread is known as the Whitworth standard thread.

T F 30. The thread angle of the American Standard thread is 60 deg. while the thread angle of the Whitworth Standard thread is 55 deg.

T F 31. The ideal thread to use for transmitting power of motion parallel to the axis is the square thread.

T F 32. A modification of the square thread and one which is much stronger and easier to cut is the 29 deg. Acme thread.

T F 33. The crests and roots of the American Standard thread are flattened 1/6 of the pitch.

T F 34. A thread having the advantage of the square thread, the shearing strength of the V thread and used to transmit power in one direction only is the Buttress thread.

T F 35. The depth of the square thread and the Acme thread is equal to the pitch.

T F 36. The crests and the roots of the Buttress thread are flattened 1/6 of the height of the thread.

T F 37. A thread that advances into a nut or a tapped hole when turned in clockwise direction is a right-hand thread.

T F 38. The thread angle of the Buttress thread is 45 deg.

T F 39. The thread angle of the Square thread is 29 deg.

T F 40. Threads of all diameters are represented on a drawing by using the semiconventional method of thread representation.

T F 41. The head of a fillister head cap screw will require a hole that is counterbored.

T F 42. The semiconventional method consists in drawing the exact shape of the profile of the thread and using straight lines in place of the helical curve to represent the outline of the thread.

T F 43. The series of screw thread recommended for general use is the National Fine thread or the N.F. series.

T F 44. For general use in machine work, the American Standard Association has standardized four classes of screw thread fits between bolts and nuts.

T F 45. Where it is necessary to have clearance between a screw thread and its mating part for rapid assembly, a Class 4 fit is suggested.

T F 46. The series having the greatest number of threads per inch and used mostly in automobile work is the coarse thread series or the N.C. series.

T F 47. A thread that advances into a nut or into a tapped hole when turned in a counterclockwise direction is a left-hand thread.

T F 48. For threads one inch or less in diameter, the American Standard Association has provided two forms of conventional thread representation symbols.

T F 49. Before a draftsman can draw a thread, he must have information on only one item concerning the thread.

T F 50. For a large amount of interchangeable, high quality commercial screw thread products, a class one fit is used.

T F 51. The two forms of thread representation symbols as provided by the American Standard Association are the regular form and the simplified form.

T F 52. The thread symbol which does not describe the V profile of the thread but which indicates the crests with a fine line and the roots with a heavy line both parallel to each other is called the regular form.

T F 53. Cutting threads on the inner surface of a hole is called reaming.

T F 54. The thread symbol which omits both the V profile and the cross line of the crests and of the roots but which indicates the threaded portion by dotted lines drawn parallel to the axis at approximately the depth of the thread is referred to as the simplified form.

T F 55. The series having 8 threads per inch for diameters ranging from 1 to 6 in. and used on bolts for high pressure pipe flanges, cylinder head studs, etc., is referred to as the 8-pitch thread series or N-8 series.

T F 56. A note lettered on a drawing giving the diameter of the tap drill and the depth of the drilled hole, followed by the thread specification and the length of the thread is needed for making a tapped hole.

T F 57. Before a hole is drilled, it must be tapped with a tap drill.

T F 58. The end view of a tapped hole is illustrated on a drawing by the use of three circles.

T F 59. The larger circle used to represent a tapped hole is equal to the major diameter of the thread.

T F 60. The major diameter of the end view of a tapped hole is drawn as a dotted circle on a drawing.

T F 61. The smaller circle shown in the end view of a tapped hole is equal to the outside diameter of the thread.

T F 62. The minor diameter of a tapped hole is shown on a drawing with a full circle.

T F 63. The heads and nuts of all through bolts are made square.

T F 64. The length of a bolt is measured from the underside of the head to the extreme end of the bolt.

T F 65. The threaded end of the bolt is flattened and chamfered.

T F 66. The chamfered end of the bolt is drawn to the depth of the thread at an angle of 30 deg. with the flat surface.

T F 67. The numeral preceding the letters N.C. or N.F. specifies the length of the thread.

T F 68. The cylindrical head of a cap screw slotted for a screw driver bit is called a flat head.

T F 69. The bearing surface on the bolthead or nut may be plain or it may be washer faced.

T F 70. The thickness of the washer-faced surface for all boltheads or nuts is 1/64 in.

T F 71. The diameter of washer-faced surfaces for all boltheads is equal to the diameter of the bolt.

T F 72. A bolt that passes through a hole in one piece and screwed into a tapped hole in the other piece is a tap bolt.

T F 73. A circular steel rod having no head but threaded at both ends is called a stud.

T F 74. The American Standard Association has adopted four classes of finish for both the regular series and the heavy series.

T F 75. A bolthead or nut not finished except for the threads is classed as unfinished.

T F 76. The crests and roots of the Whitworth Standard thread are rounded 1/6 of the depth of the triangle.

T F 77. A complete specification for a ⅞-in. diameter screw having 9 coarse threads per inch and a class 2 fit should be noted on the drawing in the following manner: ⅞" — 9 N.C. — 2.

T F 78. A bolt that is completely machined all over is classed as a rough bolt.

T F 79. The diameter of the top circle of the bolthead is equal to the diameter of the bolt.

T F 80. A bolthead or nut that is machined to provide a smooth bearing surface either plain or washer faced is classed as semifinished.

T F 81. In both the regular series and the heavy series, the unfinished bolthead may be either square or hexagon.

T F 82. The finished bolthead in both series is of the square type only.

T F 83. Bolts of the regular series meet the requirements as fasteners for general use.

T F 84. When a greater bearing surface is essential in fastening two machine parts, the regular series bolthead and nut may be used.

T F 85. When a finished appearance and close dimensions are required as on a jig or fixture, the various parts are fastened only with through bolts.

T F 86. Cap screws for both the N.C. and N.F. series of threads have a class 3 fit.

T F 87. A ⅜ x ⅞-in. finished cap screw with a fillister head is ⅜ in. in diameter and has 16 N.C. threads per inch with a class 3 fit. It is specified on a drawing by note in the following manner: ⅜" — 16 N.C. — 3. Fil. Hd. cap screw.

T F 88. The American Standard Association has standardized four styles to be used as heads for cap screws.

T F 89. A screw fastener similar in appearance to a cap screw but smaller in size used primarily on jigs and fixtures is the machine screw.

T F 90. Standard machine screws are made in finished form only with threads cut either to the N.C. thread series or the N.F. thread series.

T F 91. There are six different forms of standardized heads for machine screws in use today.

T F 92. Some machine screw heads are made with a slot for the use of a screw driver.

T F 93. The diameter of some machine screws is designated by number, while others are designated in fractional sizes.

T F 94. A screw made of hardened zinc is used for holding two machine parts in relative position to prevent them from turning or slipping is referred to as a setscrew.

T F 95. A setscrew with a projecting head which is used on moving parts is called a headless setscrew.

T F 96. A piece of steel used as a fastener to lock a wheel to a shaft and cause the wheel to turn with the shaft is called a rivet.

T F 97. The formula for finding the height of an unfinished regular hexagon bolthead is 3/4D plus 1/16 in.

T F 98. The formula for finding the distance across the flats of a heavy series hexagonal head or nut is 1½D plus ⅛ in.

T F 99. The thickness of a hexagonal nut for a regular finished bolt is ⅞D.

T F 100. A semicircular key made to fit into a semicircular groove cut in a shaft so that the key can adjust itself to the taper in the keyway of the hub is known as a feather key.

ANSWERS FOR TRUE-FALSE EXERCISES ON FASTENINGS

1. T	11. F	21. T	31. T	41. T
2. T	12. F	22. F	32. T	42. T
3. F	13. F	23. T	33. F	43. F
4. T	14. T	24. F	34. T	44. T
5. T	15. T	25. T	35. F	45. F
6. T	16. F	26. T	36. F	46. F
7. F	17. T	27. F	37. T	47. T
8. T	18. T	28. T	38. T	48. T
9. T	19. F	29. T	39. F	49. F
10. F	20. F	30. T	40. F	50. F
51. T	61. F	71. F	81. T	91. F
52. T	62. T	72. T	82. F	92. T
53. F	63. F	73. T	83. T	93. T
54. T	64. T	74. F	84. F	94. F
55. T	65. T	75. T	85. F	95. F
56. T	66. T	76. T	86. T	96. F
57. F	67. F	77. T	87. T	97. F
58. F	68. F	78. F	88. F	98. T
59. T	69. T	79. F	89. T	99. T
60. T	70. T	80. T	90. T	100. F

AIRCRAFT DRAFTING EXAMINATION

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1. A complete circle is divided into ..... number of degrees.

2. One minute is what part of a degree? .....

3. Fourteen degrees and ten minutes are written with the following symbols: .....

4. A pentagon has ..... sides.

5. What two traingles may be combined to make an angle of 15 degrees? .....

6. Make a sketch showing roughly the shape of an elipse. .....

7. Trisect means to cut into ..... parts.

8. When it is hard to show the interior details with regular view, what kind of drawing is made? .....

9. The symbol for aluminum in cross section is as follows: .....

10. The symbol for a babbitt in cross section is as follows: .....

11. The symbol for a bronze in cross section is as follows: .....

12. Make a small sketch showing the use of a revolved section: .....

13. Make a sketch showing a conventional treatment using violation of theory. .....

14. A hinged or moving portion of airplane wing attached to the trailing edge is called .....

15. Any surface such as an airplane wing designed for reaction from the air through which it goes is called .....

16. A scoop or hood designed to catch the air to cool an engine is called a .....

17. A removal covering over radial engines is called .....

18. Any small piece used in an airplane especially for fastening members together is called a .....

19. The body of a plane to which the plane wings, tail, etc., are attached .....

20. The foremost edge of an airfoil or propeller is called a .....

21. The pump for supplying the engine with a greater weight of air than would normally be available is a .....

22. The rearmost edge of an airfoil is called the .....

23. The outline of a wing section is the .....

24. When right- and left-hand parts are to be made, which one of the two is shown? .....

25. Knurling is a kind of finish. Describe how it appears. .....

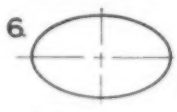
26. Chamfers are usually made on what angle? .....
27. A casteled nut is one provided with .....
28. Two common symbols for showing threads are ..... and .....
29. Two common ways of showing tapped holes are ..... and .....
30. A stud bolt is one with threads on .....
31. Interpret this note: 9/16 — 12 — N.C. — 2 .....
32. Interpret this note: 5/16 — 24 — N.F. — 4 .....
33. The cross section of a piece of streamlined tubing looks about as follows: .....
34. A section of bulb angle looks as follows: .....
35. Turnbuckles are used for what purpose? .....
36. When common fractions are given to dimension machine parts less than ¼ in. in size, it is understood that the work is to be accurate within ..... inch.
37. If a dimesion of ¾ in. is given as a common fraction, it is understood that it is to be accurate within ..... inch.
38. If you wished to finish a ¾-in. hole very accurately you would do it with what tool? .....
39. If a small round surface is to be made true, it would be done by what process? .....
40. The principal beam that extends the whole length of the wing is called .....
41. Metal that is formed by being forced through dies is said to be .....
42. Metal that is hammered out when it is hot is said to be .....
43. When hot metal is poured into a mold it is said to be .....
44. When a structure is under a pulling force, it is said to be under .....
45. When a force causes a squeezing condition the member is said to be under a .....
46. "Alclad" is coated with pure .....
47. The tail assembly is called the .....
48. An engine with cylinders arranged in a circle is said to be ..... type.
49. An engine with horizontal cylinders arranged on both sides of the crankshaft is called ..... type.
50. One of the principal advantages of the in-line type engine is that it affords less .....
51. A small auxiliary airfoil attached to the control surface for the purpose of trimming the plane is called a .....
52. The movable vertical part of the tail section is called the .....
53. The rigid horizontal part of the tail section is called the .....
54. Joggles are frequently necessary in airplane construction. Make a sketch showing what they are: .....
55. In studying an airplane print, where should one begin? .....
56. A full-size pattern that is used for laying out parts by marking around it is called a .....
57. What light metal other than aluminum is used extensively in airplane construction? .....
58. When different metals are mixed to give improved quality they are called .....

Supply the words for which these are abbreviations:

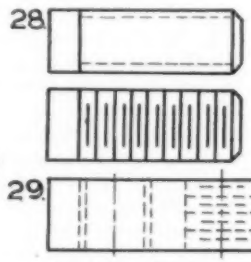
59. Hyd.	66. Csk.	73. H.p.	80. R.	
60. Alt.	67. Cu. Ft.	74. Hr.	81. R.H.	
61. Alum.	68. Cyl.	75. I.D.	82. R.Hd.	
62. An.	69. Dia.	76. L.h.	83. Sq. Ft.	
63. Cstg.	70. Dwg.	77. M.p.h.	84. Std.	
64. C.–C.	71. Ga.	78. Min.	85. Temp.	
65. Cham.	72. H.T.	79. Prop.	86. Thd.	

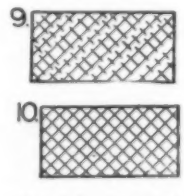
KEY

1. 360
2. 1/60
3. 14° 10′
4. 5
5. 45° and 30°

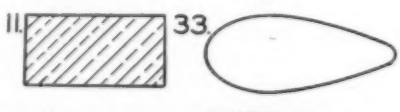


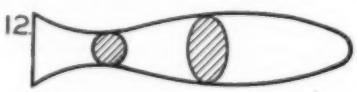
7. 3
8. cross section

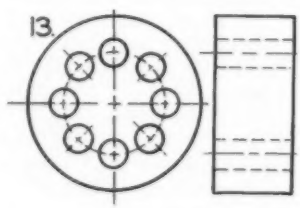




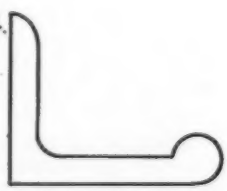
30. both ends
31. 9/16-in. dia. — 12 threads per inch — National coarse — No. 2 fit
32. 5/16-in. dia. — 24 threads per inch — National fine — No. 4 fit



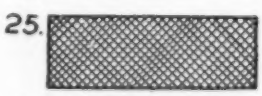




14. aileron
15. airfoil
16. air scoop
17. cowling
18. fitting
19. fuselage
20. leading edge
21. supercharger
22. trailing edge
23. airfoil section
24. left hand



35. tighten wires and cables
36. 1/128 in.
37. 1/64 in.
38. reamer
39. spot facing
40. spar
41. extruded
42. forged



26. 45 deg.
27. slots

43. cast
44. tension
45. compression
46. aluminum
47. empenage
48. radial
49. opposed
50. air drag or resistance
51. trim tab
52. rudder
53. stabilizer
55. title block
56. template
57. magnesium
58. alloys
59. hydraulic
60. altitude
61. aluminum
62. army-navy
63. casting
64. center to center
65. chamfer
66. countersink
67. cubic feet
68. cylinder
69. diameter
70. drawing
71. gauge
72. heat treat
73. horse power
74. hour
75. inside diameter
76. left hand
77. miles per hour
78. minute
79. propeller
80. radius
81. right hand
82. roundhead
83. square feet
84. standard
85. temperature
86. thread

TEST IN GENERAL METALWORK

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Directions: Of the following 100 statements, some are true, and others are false. If, in your opinion the statement is true, place a T before it. If the statement is not true place an F before same.

( ) 1. Over four fifths of the weight of an automobile is iron and steel.
( ) 2. The average passenger car contains about two and one-half tons of iron parts.
( ) 3. To the metallurgist each type of steel has its own particular use and is just as different to him as day is to night.
( ) 4. The way an automobile is made depends entirely upon the materials which are available.
( ) 5. Valve materials operate for thousands of miles at red heat.
( ) 6. Spring materials, due to the frequency of bumps, must be replaced at the end of two years.
( ) 7. Special tool steels have made large scale production of the automobile possible.
( ) 8. Metallurgy is one of the newest of the arts and one of the oldest of the sciences.
( ) 9. Iron and steel expand when heated and contract when cooled.
( ) 10. Your automobile is over an eighth of an inch longer on a hot day than it is on a cold winter's day.
( ) 11. Repeated heating to red heat and cooling of cast iron will result in shrinkage of the metal.
( ) 12. Thousands of years ago, iron was called "ba-en-pet," the metal from heaven.
( ) 13. The use of iron in Egypt can be traced back 3500 to 4000 B.C.

( ) 14. The use of iron was widespread in the year 3800 B.C.
( ) 15. The first metallic iron to be used by man came from Sidney, Australia.
( ) 16. Meteorites are composed of iron, steel, brass, and zinc.
( ) 17. Iron is rarely found in lakes, streams, rivers, and other natural waters.
( ) 18. The body of a man is said to contain from a quarter to half ounce of iron.
( ) 19. About one twentieth of the earth's crust is iron and it is the fourth most abundant metal.
( ) 20. Scientists tell us that the inside core of the earth is composed of almost one half solid iron.
( ) 21. When iron is exposed to moist air, it combines with oxygen to form rust.
( ) 22. The raw materials for your automobile are really iron rust.
( ) 23. In the United States, Minnesota, Michigan, and South Dakota produce most of the iron ore in use today.
( ) 24. Iron ore has been found in Connecticut, Georgia, Nevada, Texas, and Delaware.
( ) 25. The iron ore mined in the United State usually contains over 80 per cent iron.
( ) 26. In some European countries the ore is used when it contains only about 25 per cent of iron.
( ) 27. Iron ore also has other impurities such as sulphur, silicon, aluminum, and manganese, which are not wanted in iron.
( ) 28. It is necessary that the oxygen in iron ore must be left in to leave the iron free as a metal.
( ) 29. Smelting is a process which is carried out at a medium temperature.
( ) 30. The extraction of iron from the ore originated in Egypt.
( ) 31. The forerunner of our modern furnaces was the Catalan forge developed in the province of Catalonia in the northern part of Spain.
( ) 32. The Catalan forge was a deep cavity made of brick or stone and usually rectangular in shape.
( ) 33. One of the greatest contributions made to the process of extracting iron from the ore was made by Mr. Dudley, who, in the year 1620, substituted coal for the wood charcoal previously used in smelting.
( ) 34. About 1720 Abraham Darby substituted gas for coal and made the process a success.
( ) 35. The iron made in the ancient furnaces was very pasty and stiff.
( ) 36. The iron pots and frying pans in the King's palace were classed among the royal jewels during the reign of King Edward III of England.
( ) 37. The blast furnace is huge, rectangular in shape and made of stone and brick.
( ) 38. The furnace has air entrances near the bottom and openings near the top to carry the gases away.
( ) 39. The temperature of the molten pig iron in a blast furnace is 1000 deg. F.
( ) 40. The molten iron is drawn off through an opening in the side of the furnace every few hours.
( ) 41. A single large blast furnace will make 600 tons of iron a day, or as much as there is in 400 medium sized automobiles.
( ) 42. The iron which comes from the furnace is called pig iron.
( ) 43. Pig iron is used as the raw material for making cast iron and steel.
( ) 44. Steel is an alloy of iron and carbon in which the carbon varies between a few hundredths of a per cent to 1.7 per cent.
( ) 45. The more carbon in the alloy the stronger is the metal.
( ) 46. A hard steel often contains 5.7 per cent of carbon.
( ) 47. Steel is more important than gold, silver, and copper in its effect upon civilization.
( ) 48. Iron pyrites is a compound of iron, copper, and silicon which has a pale orange color.
( ) 49. Wrought iron, due to the abundance of carbon in it, is very tough and rigid.
( ) 50. The automobile is the largest single user of the steel produced in the United States.
( ) 51. In an ordinary year about 10 million tons of steel are used in this industry.
( ) 52. Over one half of the malleable iron and one seventh of the gray cast iron is used to manufacture automobiles.
( ) 53. Henry Bessemer, the inventor of the Bessemer converter, was born in England, of French parents, in 1813.
( ) 54. Sulphur in steel decreases the brittleness to shock or severe blows.
( ) 55. Bessemer discovered, after many years of experimentation that blowing aid through molten cast iron or pig iron made the iron hotter.
( ) 56. William Kelly, of Waterbury, Conn., developed a process similar to Bessemer's and received a patent for his invention in 1857.
( ) 57. A Bessemer converter is a large round shaped container lined with asbestos and open at the top.
( ) 58. It takes a ton of iron ore, a half ton of coke, and 600 pounds of limestone to produce a half a ton of open hearth steel.
( ) 59. In 1863, Sir William Siemens, in conjunction with a man by the name of Martin, developed a new type of furnace called the open hearth furnace.
( ) 60. In an open hearth furnace, an outside source of heat, gas, is used, admitted through two openings at each end of the furnace.
( ) 61. Gas, rich in unburnt carbon, is produced in a separate furnace at one side and connected to the gas chamber by long tubes.
( ) 62. The air and gas come together under the bath of molten metal.
( ) 63. The acid open hearth process can only be utilized with iron high in phosphorus.
( ) 64. The steel made by the Bessemer process is cleaner than the steel made in an open hearth furnace.
( ) 65. The highest quality of steel is made by the electric process because no outside impurities are introduced by a fuel, and because melting conditions can be controlled better.
( ) 66. Before the steel has left the furnace it is poured into molds and cast into ingots.
( ) 67. The automobile uses the largest percentage of strip, bar, and sheet steel which forms are produced in the steel mill from the white hot billets.
( ) 68. A rolling mill works the steel ingots something like a rolling pin works pie crust.
( ) 69. The hot steel billet is pressed between two stationary rolls.
( ) 70. After the hot steel has passed through the rolls once it emerges perfectly formed.
( ) 71. Sheets are sometimes coated with various materials such as tin, zinc, to prevent them from rusting.
( ) 72. Seamless steel tubing is made by piercing a round billet of the proper size and then reducing the wall thickness and diameter in suitable rolls.
( ) 73. The sun and stars owe much of their brilliancy to clouds of incandescent carbon, thousands of miles deep, which encircle them.
( ) 74. Low carbon steels, those with up to ¼ per cent carbon, are very hard and must be heated to be bent.
( ) 75. Body panels, frames, fenders, gas tanks, and many small pressed parts are made of high carbon steel.
( ) 76. Medium carbon steels are much stronger than low carbon steels and their strength may be greatly increased by heat treatments.
( ) 77. Steels with small quantities of elements other than carbon, phosphorus, sulphur, and silicon are known as alloy steels.
( ) 78. The first use of manganese was in glassmaking where it was used to bleach glass to a crystalline clearness.
( ) 79. All steel contains large amounts of manganese.
( ) 80. Silicon is the second most abundant element on the earth's crust and combined with oxygen and other

elements it forms sand, quartz, agate, opal, and flint.

( ) 81. Most of our modern nickel comes from Arkansas.

( ) 82. Nickel steels are much used where little strength and toughness are required.

( ) 83. Chromium is a hard silvery white metal used for plated parts on automobiles.

( ) 84. When chromium and silicon are used a heat and corrosion resisting steel results.

( ) 85. Tungsten, familiar to us as the filament of electric light bulbs, is a hard metal which melts at a temperature of 2000 deg. F.

( ) 86. When tungsten, chromium, vanadium, molybdenum or manganese are added to steel in the proper amounts, high speed steel, a hard fast cutting steel is produced.

( ) 87. One out of every five people gainfully employed in the United States is employed directly or indirectly in the automobile industry.

( ) 88. Molybdenum is a hard silvery-white metal which is used with nickel in the manufacture of transmission and rear axle gears.

( ) 89. Skilled mechanics, tool designers, metallurgists, and production men take up the materials where the iron and steel men left off, and by various processes, produce the automobile.

( ) 90. To make a casting, it is first necessary to have a pattern made of wood or metal in the shape which we wish to cast.

( ) 91. The process of casting is similar to making jelly in molds — the liquid jelly being poured into a mold of the desired shape and removed when the jelly has cooled.

( ) 92. Cast iron is low in cost, very tough, and can be hammered or formed when cold.

( ) 93. Cast iron is used for parts where strength is a major requirement.

( ) 94. Forging is the process of forming steel through the use of bending jigs.

( ) 95. On a press the upper die is stationary.

( ) 96. Sheet steel for presswork is soft and ductile and contains very little carbon.

( ) 97. Lathes, milling machines, grinders, drill presses, planers, shapers, and broaches, are classed as machine tools.

( ) 98. When a car rolls off the assembly line, even the smallest car has the equivalent of almost three months of a man's labor.

( ) 99. Oil, gas, or electric furnaces are used for heating parts to be hardened, annealed, tempered, or carburized.

( ) 100. Welding is the term applied to the joining together of two pieces of steel, usually by fusing the parts at the joint.

Reference: "Metallurgy and Wheels," published by General Motors Corp., Detroit, Mich.

KEY FOR TEST IN GENERAL METAL

1. T	21. T	41. T	61. T	81. F
2. F	22. T	42. T	62. F	82. F
3. T	23. F	43. T	63. F	83. T
4. F	24. T	44. T	64. F	84. T
5. T	25. F	45. F	65. T	85. F
6. F	26. T	46. F	66. F	86. T
7. T	27. T	47. T	67. T	87. F
8. F	28. F	48. F	68. T	88. T
9. T	29. F	49. F	69. F	89. T
10. T	30. F	50. T	70. F	90. T
11. F	31. T	51. F	71. T	91. T
12. T	32. F	52. T	72. T	92. F
13. T	33. T	53. T	73. T	93. F
14. F	34. F	54. F	74. F	94. F
15. F	35. T	55. T	75. F	95. F
16. F	36. T	56. T	76. T	96. T
17. F	37. F	57. F	77. T	97. T
18. T	38. T	58. T	78. T	98. T
19. T	39. F	59. T	79. F	99. T
20. F	40. F	60. T	80. T	100. T

TEST — MECHANICAL DRAWING

FRED DECKER
Detroit, Michigan

General Directions: This test will take approximately forty minutes. Read the directions for each part carefully. It will not be necessary to ask questions.

Part I — True-False Test (Perfect Score, 50)

Directions for items 1–50. Some of the following statements are true and some are false. If you think the statement is true, draw a circle around the capital letter *T* at the left. If you think the statement is false, circle the letter *F*. Your score will be the number of right answers.

Example: (T) F The appearance of a drawing may be ruined by poor lettering.

T F 1. Legibility is one of the most important requirements for lettering used on working drawings.

T F 2. A working drawing should be lettered neatly and rapidly.

T F 3. It is widely accepted as good practice in the technical world to use single stroke gothic letters.

T F 4. Only capital letters should be used in the record strip.

T F 5. Lettering should be of correct weight to produce legible prints from tracings either in pencil or ink.

T F 6. Lettering should not be underlined.

T F 7. For drawing in orthographic projection the third angle system has been used in the United States.

T F 8. In third angle projection the top view is placed directly below the front view.

T F 9. There are three possible principal views of an object.

T F 10. Only the necessary views should be drawn to show clearly the shape of the object.

T F 11. Cylindrical parts may be shown in one view.

T F 12. Hidden edge lines should not begin with a dash in contact with the outline of the drawing.

T F 13. All lines must be clean and black in order to produce a good blueprint.

T F 14. Three weights of lines are considered desirable on finished drawings.

T F 15. For pencil drawings use medium weight line for outline of parts.

T F 16. Extension lines are drawn heavy.

T F 17. Dimension lines are made unbroken except for the space for the dimension.

T F 18. Extension lines should touch the outline of the object.

T F 19. Hidden edge lines are of medium weight with short dashes.

T F 20. Section lines are of light weight spaced evenly to make a shaded effect.

T F 21. Sectional views are drawn when the interior construction cannot be shown clearly by outside views.

T F 22. A sectional view shows the top part of the object cut or broken away.

T F 23. Section lining is sometimes called crosshatching.

T F 24. Hidden lines beyond the cutting plane are omitted.

T F 25. Section lines are light lines drawn at 60 deg. with the border line.

T F 26. Section lining should be drawn in opposite directions when two adjacent parts are shown.

T F 27. Dimension all drawings so that the parts can be made without scaling the drawing.

T F 28. Parts requiring great accuracy should be dimensioned in common fractions.

T F 29. When all dimensions are given in inches, the inch symbol is omitted.

T F 30. Fractions should be written with the division in line with the dimension line.

T F 31. Leaders should be made up of light, straight lines ended by an arrowhead.

T F 32. A center line may be used as a dimension line.

T F 33. All dimensions read from the bottom or right hand edges of the drawing.

T F 34. Over-all dimensions are placed outside the intermediate dimensions.

T F 35. The dimensions of angles should read from the vertical position.

T F 36. "D" always follows the dimension of a radius.

T F 37. Drilled, reamed, punched, or cored holes show the diameter on a leader.

T F 38. Accurate dimensions are expressed in decimals and give limits.

T F 39. Threads are always considered to be "right hand" unless specified "left hand" or "L.H."
T F 40. Threads in a small hole are made by using a tap.
T F 41. All machine tool operations remove metal.
T F 42. The lathe is capable of producing all other machine tools.
T F 43. Facing is a common milling machine operation.
T F 44. A cored hole may be finished by boring.
T F 45. Drilling is often done in the lathe.
T F 46. Careful inspection is not an important part of modern industry.
T F 47. A 60-deg. V indicates surfaces to be machined.
T F 48. Screw threads may be cut on the lathe.
T F 49. The American national coarse screw thread series was formerly called U.S.Std.
T F 50. The fine thread series was formerly called S.A.E.

Part II — Matching (Perfect Score, 10)

Directions for items 51–60: In the two columns below are listed common drafting terms. Place in the ( ) parenthesis in front of the phrase in column 1 the identifying letter of the word or phrase in column 2 which is most closely related in meaning. Use each letter but once. Your score will be the number of right answers.

Example: (N) A very soft pencil. *Example:* N. 5B pencil.

Column 1

( ) 51. A fluted tool used for cutting internal screw threads.
( ) 52. Indicates the diameter of a circle.
( ) 53. To roughen or indent a turned surface, as a knob or a handle.
( ) 54. A round hole made in metal by means of a boring tool.
( ) 55. The surface produced by cutting tools.
( ) 56. To finish a drilled, bored, or punched hole with a rotating fluted tool to make it the exact size, round, and smooth.
( ) 57. To make a round hole with a twist drill.
( ) 58. Placed upon something else.
( ) 59. A twist drill used to drill a hole preparatory to tapping.
( ) 60. A form made of sand and linseed oil and placed in a mold to make any desired opening in a casting.

Column 2

A. arrowheads
B. bore
C. break lines
D. core
E. "D"
F. die
G. drawing board
H. drill
J. finish
K. knurl
L. leader
M. ream
N. superimposed
O. tap
P. tap drill

Part III — Multiple-Choice (Perfect Score, 25)

Directions for items 61–85: Each of the following items has four alternative answers, only one of which is correct. Underline the correct answer and write its number in the ( ) parenthesis at the left. Your score will be the number of right answers.

Example: (1) The appearance of a drawing may be ruined by (1) *poor*, (2) good, (3) fair, (4) excellent lettering.

( ) 61. The most important requirement for lettering is to be able to letter (1) easily, (2) clearly, (3) rapidly, (4) neatly.
( ) 62. The height of the letters used in notes on drawings are (1) 3/16, (2) 1/8, (3) 1/4, (4) 3/32, of an inch.
( ) 63. The division line of a fraction should be (1) slanting, (2) above the dimension line, (3) in line with the dimension line, (4) below the dimension line.
( ) 64. Only (1) lower case letters, (2) capital letters at the beginning of the sentence, (3) capitalize principal words, (4) capital letters are used in the record strip.
( ) 65. Keep the guide lines for lettering (1) very light, (2) light, (3) medium, (4) heavy.
( ) 66. The height of a fraction should be (1) one-and-a-half times that of the whole number, (2) twice the height of the whole number, (3) the same height of the whole number, (4) three times the height of the whole number.
( ) 67. The most practical pencil to select for drafting would be (1) H, (2) HB, (3) 3H, (4) 6H.
( ) 68. In orthographic projection the right side view is placed to the right of and facing the (1) front, (2) top view, (3) bottom view, (4) rear view.
( ) 69. The extension line is one of the (1) four, (2) three, (3) two, (4) five weights of lines considered desirable on finished drawings in ink.
( ) 70. Visible edges should be the outstanding feature of the drawing and are drawn (1) light, (2) heavy, (3) medium, (4) very light.
( ) 71. The end view of a round, solid bar is indicated by (1) a full circle inside a dashed one, (2) one full circle, (3) two full circles, (4) a full circle outside a dashed one.
( ) 72. A sectional view should be made as if, on that view, the (1) top, (2) rear, (3) front, (4) bottom of the object were cut or broken away.
( ) 73. A cutting plane line is a (1) heavy, (2) light, (3) medium, (4) very light broken line.
( ) 74. Section lines are light, parallel lines drawn at an angle of (1) 25 deg., (2) 35 deg., (3) 60 deg., (4) 45 deg. with the border line of the drawing.
( ) 75. Dimension lines are (1) light, (2) heavy, (3) medium, (4) very heavy.
( ) 76. A 6H pencil is (1) soft, (2) hard, (3) medium, (4) very hard.
( ) 77. The pencil should be sharpened so that the lead will protrude (1) 1/8, (2) 1/16, (3) 1/4, (4) 3/8 in.
( ) 78. The T square is made up of the head and the (1) handle, (2) blade, (3) frame, (4) tongue.
( ) 79. Dimensions up to (1) 62, (2) 49, (3) 72, (4) 59 in. are written in inches.
( ) 80. Dimension lines are ended with arrowheads whose lengths are about (1) two, (2) three, (3) four, (4) five times the spread.
( ) 81. Extension lines extend about (1) 1/8, (2) 1/16, (3) 1/32, (4) 1/4 beyond the dimension line.
( ) 82. Leaders are usually drawn (1) 45, (2) 15, (3) 75, (4) 60 deg. to the horizontal.
( ) 83. Angles are measured in (1) inches, (2) feet, (3) meters, (4) degrees.
( ) 84. Dimensions may be given from a (1) cutting plane, (2) hidden edge, (3) center line, (4) break line.
( ) 85. In dimensioning angles an arc should be drawn and the dimensions placed so as to read from the (1) horizontal, (2) vertical, (3) 45-deg. (4) 60-deg. angle.

Part IV — Completion (Perfect Score, 25)

Directions for items 86–110: Place the correct word in the blank space to make the sentence complete and correct. The figure in the ( ) parenthesis indicates the number of letters in the answer. Your score will be the number of correct answers.

Example: The appearance of a drawing may be ruined by poor *lettering*. (9)

86. In orthographic projection the top view is placed directly above the .....(5) view.
87. There are .....(3) possible principal views of an object.
88. A hidden edge line always starts with a dash in .....(7) with the line.
89. It is considered desirable to have ....(5) weights of lines on finished drawings in ink.
90. Dimension lines are .....(8) except at dimensions.
91. A draftsman should know how to ....(4) the things that he draws.
92. Center lines locate the centers of ....(7).
93. Sectional views show interior construction when this cannot be shown by ....(7) views.
94. Dimensions should not be ....(9) on various views or a single view.
95. Parts that can be produced with sufficient accuracy by using a rule are written in common .....(9).
96. The symbol (″) is used to indicate inches and common and .....(7) fractions of an inch.

97. The note end of the leaders should always run either to the beginning or end of the .....(4).

98. A center line should not be used as a .....(9) line.

99. All dimension lines and figures should read from the .....(6) or right hand edges of the drawing.

100. All dimensions should read in the direction of the .....(9) lines.

101. When there are several parallel dimension lines the figures are .....(9) to avoid confusion.

102. Always give the .....(5) over-all dimensions.

103. Over-all dimensions are placed ....(7) any other dimensions.

104. Dimensions are placed around the views to show the .....(4) of the object.

105. A plan view of a tapped tole is indicated by a full circle inside a .....(6) circle.

106. The threads in a small hole are cut with a .....(3).

107. Mechanical drawing is understood to mean drawing with the aid of .....(11).

108. The pencil should be sharpened on the opposite end from where the .....(5) mark appears.

109. Good drawing boards are usually made of some .....(8).

110. Lines at 15 and 75 deg. may be drawn by combining the two .....(9).

Key — Drafting Sheet
(Answer sheet)
Course (2)

NAME .....
GRADE ..... HOUR ..... COURSE NO. ...
CORRECTED BY .....

Scoring Record

Part Description	*Perfect Score*	*Student's Score*
1. True-False	50	.....
2. Matching	10	.....
3. Multiple-Choice	25	.....
4. Completion	25	.....
Total Score	110	.....

1. T	26. T	51. O	76. 4
2. T	27. T	52. E	77. 4
3. T	28. F	53. K	78. 2
4. T	29. T	54. B	79. 3
5. T	30. T	55. J	80. 2
6. T	31. T	56. M	81. 1
7. T	32. F	57. H	82. 4
8. F	33. T	58. N	83. 4
9. F	34. T	59. P	84. 3
10. T	35. F	60. D	85. 1
11. T	36. F	61. 2	86. front
12. F	37. T	62. 2	87. six
13. T	38. T	63. 3	88. contact
14. T	39. T	64. 4	89. three
15. T	40. T	65. 1	90. unbroken
16. F	41. T	66. 1	91. make
17. T	42. T	67. 3	92. objects
18. F	43. F	68. 1	93. outside
19. T	44. T	69. 2	94. duplicate
20. T	45. T	70. 2	95. fractions
21. T	46. F	71. 2	96. decimal
22. F	47. T	72. 3	97. note
23. T	48. T	73. 1	98. dimension
24. T	49. T	74. 4	99. bottom
25. F	50. T	75. 1	100. dimension
101. staggered	105. dashed	108. grade	
102. three	106. tap	109. softwood	
103. outside	107. instruments	110. triangles	
104. size			

Go back over your work.

FINAL EXAMINATION IN MECHANICAL DRAWING III

A. CALANDRO
Eastchester High School
Tuckahoe, N. Y.

Part I — 25 Credits

Identification Statements: Each of the following statements identifies a word or words in the list: write this word or words on the line at the right of the statement. (5 points)

a) addendum
b) base circle
c) dedendum
d) circular pitch
e) diametral pitch
f) pitch diameter
g) root diameter
h) outside diameter
i) gears
j) clearance
k) keys
l) tooth thickness
m) whole depth
n) working depth
o) pressure angle

1. Measured on the pitch circle .....
2. Distance from the center of one tooth to the center of the next .....
3. Addendum plus dedendum .....
4. Transmit motion between parallel shafts .....
5. Diameter of the pitch circle .....
6. Used to fasten gears to shafts .....
7. Distance from pitch circle to top of tooth .....
8. Generating circle for curve to form tooth profile .....
9. Number of teeth divided by diameter of pitch circle .....
10. Diameter of circle containing bottoms of tooth spaces .....

True and False Statements: Read carefully, then mark a *T* or *F* in front of each statement according to whether it is *true* or *false*. (20 points)

.... 1. The fillet is the distance between the root circle and the clearance circle.
.... 2. The pitch circles on spur gears are the same as the circumferences of imaginary cylinders in contact.
.... 3. The face of the tooth is also known as the addendum.
.... 4. The flank and dedendum are synonymous.
.... 5. In a gear of 32 teeth, with a pitch of four, the diameter of the pitch circle is eight.
.... 6. The circular pitch is measured on the pitch circle, whereas the thickness of the tooth is measured on the base circle.
.... 7. Radial lines form part of the gear tooth.
.... 8. To find the pitch circle you multiply the circular pitch by the diametral pitch.
.... 9. Diametral pitch, circular pitch, and pitch circle are synonymous.
.... 10. The root circle determines the bottom of the tooth space.
.... 11. A gear that has a pitch of 3, must have an addendum of 1/3 in.
.... 12. A gear that has a pitch of 2, must have a dedendum of 1/2 in.
.... 13. Clearance is the shortest distance between the top of a tooth and the bottom of its mating space.
.... 14. Common tangent is a line tangent to the tooth profile.
.... 15. Pitch point is the point of tangency of the base circles of two gears in mesh.
.... 16. Both tooth thickness and tooth space in a gear are the same in size.
.... 17. The teeth of two gears in mesh are the same in thickness.
.... 18. The curve on a rack tooth is the same as that of the teeth of the meshing gear.
.... 19. Part of the rack tooth profile is a 15-deg. line.
.... 20. In working drawings of gears not all of the teeth are drawn.
.... 21. A cam is a machine part so shaped that by its movement it transmits a definite motion to a second machine part.
.... 22. Only one desired motion can be transmitted by means of cams.
.... 23. As a general rule the cam is made to rotate at a uniform speed.
.... 24. A cylindrical cam and a plate cam are identical.
.... 25. A variable motion cam can only transmit uniform motion.
.... 26. A cylindrical cam causes its follower to move parallel to the cam axis.
.... 27. A plate cam causes its follower to move parallel to the cam axis.
.... 28. A roller follower is more desirous than a pointed follower because of the absence of friction.
.... 29. Gravity motion and uniformly accelerated and uniformly retarded motion are identical.
.... 30. Harmonic motion is used more than uniform motion because of the absence of the sudden starting and stopping.
.... 31. When the follower of a cam has a positive action it rises and falls because of a spring or gravity action.
.... 32. The groove in the face of a cam insures it of a longer life.
.... 33. A rest period means that the cam is at a standstill.
.... 34. Throw means the distance the follower is moved by the action of the cam surface.
.... 35. When the cam is turning clockwise the right side of the cam surface first affects the follower.
.... 36. The bobbin winder on a sewing machine is a good example of a nonpositive acting cam.
.... 37. A blueprint is made by placing the ink tracing with the ink lines down against the blueprint paper and ex-

posing to the sunlight in a blueprint frame.

.... 38. In making an ink tracing, it is important to keep all lines clear, sharp, and black, and of different weights.

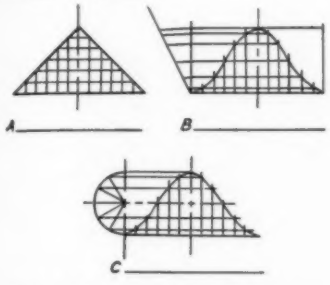
.... 39. A strong solution of ammonia is exceptionally good for cleaning ink from inking instruments.

.... 40. Cluttering up of the drafting table with books, boxes, and other unnecessary drafting tools is conducive to good draftsmanship.

Part II — 25 Credits

1. Cams may be designed to move the follower with uniform motion, harmonic motion, or gravity motion and in many cases with a combination of motions.

Correctly identify the motion diagrams illustrated. (3 points)

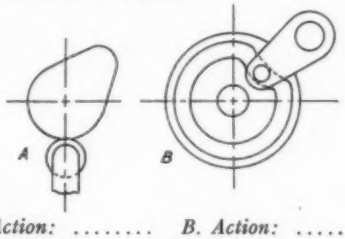


2. Cams with harmonic and gravity motions are ususally favored over those with uniform motion. Give the reason. (1 point)

Reason: .....

3. As a cam revolves it imparts either a positive or a nonpositive action to the arm or follower.

Correctly identify the action imparted by the cams illustrated and give a reason for your choice. (4 points)



A. Action: ..... *B. Action:* .....
Reason: ..... *Reason:* .....

4. It is more practical to use a roller or a pointed follower in the design of most cams. Give reason. (1 point)

Reason: .....

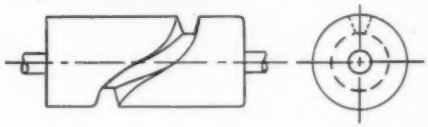
5. The *base circle* is of definite importance in the construction of any cam. Give the reason. (1 point)

Reason: .....

6. The cylindrical cam is illustrated below. Identify as to motion and movement. (2 points)

A. Positive or nonpositive action .....

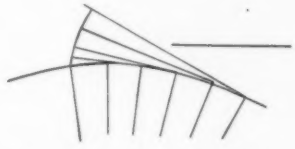
B. Movement of follower parallel or perpendicular to axis .....



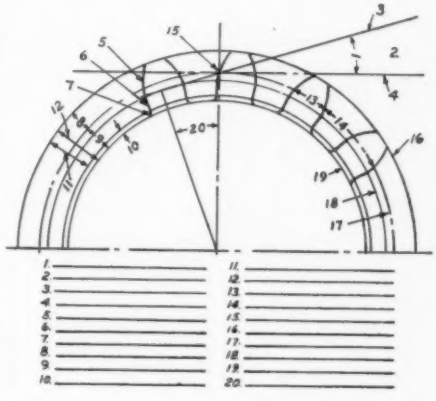
7. When two gears are in mesh the smaller of the two is called: (1 point) .....

8. Gears in mesh impart either a positive or a nonpositive action. Give the correct answer. (1 point) .....

9. Many curves may be used for tooth profiles but only the one used in this course is illustrated below. Identify. (1 point)



10. Correctly identify the general terms for gears and gear teeth by referring to the illustration below. (10 points)



Student Desires That Must Be Recognized by the Teacher

HOMER C. ROSE

Curriculum and Instructor Training Section

Navy Department, Bureau of Naval Personnel

Washington, D. C.

1. *The desire for recognition and approval by others.*

Call students by name. Let students work in groups occasionally. Use exhibits and displays of outstanding work. (Name need not be placed on the displays.)

2. *The desire for mastery of job or situation. The desire to do a good job so that student can be proud of himself.*

Tell students how they stand. Tell what the job is for. Set a high standard of performance but aid the learners to reach this standard.

3. *Desire for security and safety.*

Give a word of approval for a job well done. Use only proper reprimanding procedures. Always provide opportunities for the students to talk over their special problems with you. See that working conditions are as good as you can make them.

4. *Desire for experience and freedom to think and do.*

Allow students to work at their own speeds. Let students assist in the development of processes or special projects. Make equipment and materials available for advanced work.

5. *The desire for companionship and close friendship.*

Treat students as individuals worth knowing. Encourage friendship in the group by acting as a clearinghouse for those with interests in common.

6. *The desire to help the underdog.*

Allow advanced students to coach those having trouble. Some care should be exercised in the selection of helpers and both the helper and the man being helped must be instructed in the proper relationships.

Industrial Arts and Vocational Education
John J. Metz, Editor

KEEPING THE STUDENT INTERESTED

There are times when the entire student group may be idle for from three to five minutes, as for instance at the time of changing classes. For a class of thirty, even three minutes of idleness means ninety minutes of time wasted.

It is well for such periods to have a short program prepared that will keep the class interested and mentally alert by discussing some subject on safety, properties and uses of materials, processes and production methods used in industry, and the like.

Especially interesting to the students are talks on materials used in industry.

Take platinum, for instance. Most of the students will know that it is used for making jewelry, and that it is very expensive. Beyond that, most of them know very little about the metal.

The main facts about this metal may be told in a few minutes. Thus, it is one of the heaviest metals known. Its specific gravity is 21.4. That means that a given volume of platinum weighs almost 21½ times the same volume of water.

It is very ductile and is surpassed in this characteristic only by gold and silver. Its melting point is 3224 deg. F., while iron and steel melt at 2500, and cast iron at 2300 deg. F.

Another very interesting point is, that platinum does not oxidize and that it resists almost all alkalies and acids, and dissolves only in hot aqua regia, a mixture of nitric and hydrochloric acids.

It forms useful alloys with gold, silver, steel, iridium, and osmium, and is used in making high resistance wires, electric contact points, and wires for thermocouples. Because of its resistance against heat and acids, it is much used for laboratory equipment.

Platinum, then, is not merely a fine metal for making jewelry, but it also is a very useful metal for carrying on scientific and industrial pursuits.

Platinum is found in the Ural Mountains, in South Africa, South America, Borneo, Canada, and in the United States. Some of it is obtained while extracting gold in California and Oregon.

TESTS AND TESTING

This issue is the annual testing number of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. This year's selection contains nine tests, and the subjects covered are: aircraft propellers, architectural drawing, aircraft carburetion, radar, fastenings, aircraft drafting, metalwork, mechanical drawing.

The editor wants to repeat a statement which he has often made — the tests published in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION may contain some statements that do not represent the best of their kind.

Then, too, these tests contain many of the true and false types of statements, and there are many who will have nothing to do with this kind of a test because, as they say, pure guessing will help the student answer approximately 50 per cent of them correctly. It may be assumed, however, that the student will know the correct answers for at least part of the questions, and then if he guesses at the rest of the items, his wrong guesses would approximately wipe out those that he guessed correctly. His score, then, taken as the difference existing between those marked correctly and those marked wrong, would be very low.

Thus, if there were 100 statements and fifty were guessed right, and fifty had been guessed wrong, the score would be $50 - 50 = 0$. In other words, unless the student knows his subject fairly well, his guessing will help him little or nothing.

A formula to obviate chance applicable to other types of test exercises that offer more choices than do the true-false tests, may be written thus: $S = R - \frac{W}{N-1}$ where S is the score; R is the number of correct answers; W, the number of wrong answers; and N the number of choices given.

Thus, for a true-false test, we have: $S = R - \frac{W}{2-1} = R - \frac{W}{1}, = R - W$

For a multiple choice test with four choices $S = R - \frac{W}{4-1} = R - \frac{W}{3}$. As may be noted, this formula ignores unanswered questions entirely.

There are other methods of making tests more objective. For instance, the student may be asked to restate correctly every test item he marks false. If he does that he will be able to do but little guessing.

The idea of this testing number is to encourage every instructor of industrial arts and vocational education to use an objective method of measuring what his work during the semester has done for the pupil. Without testing, neither the teacher nor the student knows what has been accomplished.

FIRE DANGER SAFEGUARDS

The official organ of the Association of School Business Officials — *School Business Affairs* — in its October, 1949, issue, presents an article "Checklist of Fire Danger Safeguards" by N. L. Engelhardt, educational consultant, which deserves wide distribution and study.

It is the outcome of a recent survey of the San Francisco public schools, and contains much material which can be adapted in existing schools and incorporated in new schools to be erected.

Of course, the check list was developed for the entire school system in general, and could be refined for specific rooms in which special work is performed.

Thus, the author calls for approved lockers for storing paints, oils, lacquers, thinners, etc., wherever stored. He also states that covered metal cans of the self-closing type be used for paint rags.

It may be noted in passing that there are some paint shops in trade and vocational schools where the surplus paint, when a job is ended, is dumped into a large cask which at times holds thirty to fifty gallons of paint. It ought to be made a strict rule that this cask be covered at all times with a metal cover. Such an open paint barrel is a definite fire hazard.

Lumber storage also requires special safeguarding, especially in the way of emphasizing the need of keeping the surroundings of the lumber piles very clean and orderly so that there never is an accumulation of shavings or small pieces of wood around the base of the piles.

Areas in any shop that present special fire hazards should, of course, be provided with a larger number and type of fire extinguishers, and it cannot be emphasized too strongly that these extinguishers be examined frequently so that they are always ready for use.

Instructor Training in the Navy

HOMER C. ROSE

Head, Curriculum and Instructor Training Section

Training, Bureau of Naval Personnel

Navy Department

Washington 25, D. C.

(Continued from page 7 of the January, 1950, issue)

The NROTC Instructor Training Plan

Another major instructor training program is that of NROTC. Each summer the instructors assigned with the professors of naval science in the various universities meet at Northwestern University for an indoctrination course of three weeks' duration. The purpose of this course is to provide accurate information about the NROTC program and to give newly assigned instructors some training and experience in public speaking, lesson planning, demonstration techniques, and testing. The staff for this special course is drawn from the Instructor Training Section of the Bureau of Naval Personnel and representatives from Northwestern University, the U. S. Office of Education, the U. S. Naval Academy, and other schools. Every effort is made to obtain specialists in each of the several phases of the course.

During the year BuPers representatives from the Curriculum and Instructor Training Section visit the NROTC units for the purpose of giving additional help on instructional procedures as well as on the administration of the NROTC program. Many special problems on such matters as the personnel counseling programming, the procurement of equipment for the armories, and the modification of the curriculum are expedited through these visits.

Training Program for Service School Officers

A number of special instructor training projects are carried on from time to time. A good example of this is the program for training service school officers in school administration. Many officers assigned as school administrators have had little experience leading to the effective administration of a school type training program. George Washington University was put under contract in 1947 to assist the navy in providing a special course in school administration for service school officers. This was done by conducting a series of conferences at several locations throughout the country in which school officers received training in school administration and in the principles of education. Following these conferences, each officer was given a correspondence course in which he worked out training problems pertaining to his specific school. Correspondence was carried on between the officer concerned and a member of the George Washington University staff. At the end of the correspondence period a second series of conferences was held to clear up misconceptions and to provide further training. This course has proved to be highly successful with service school officers and its continuation in some form is contemplated.

The Curriculum and Instructor Training Section

This section is one of five in the standards and curriculum branch, Training Division, Bureau of Naval Personnel. One of its missions is to provide curricula for all schools under the management control of the Bureau of Naval Personnel, the naval reserve training program, and special courses dealing with the training of naval personnel. A second mission is that of providing instructor training services for navy training programs. A third mission is the providing of assistance to naval personnel on all levels in connection with the various aspects of training.

Analysis of School Problems: Members of the section do considerable work in which they confer with school administrators, commanding officers of recruit training and service school commands, and district directors of training. The objectives of visits to field activities vary from that of providing useful information on developments and BuPers policy to that of studying specific schools for the purpose of making recommendations for improvement in instruction and the administration affecting instruction. Since the improvement of instruction is frequently based on school administration, the section takes an active part in assisting with the establishment of sound administrative practices in the various schools. Such matters as that of determining the length of the school week and the scheduling of classes within the week are studied and commented upon by the section.

Instructor Training Plans: The section is responsible for the development and direct implementation of plans for instructor training throughout the navy. For example, the section devised the over-all plan for the establishment of the two previously mentioned instructor training schools, wrote the curricula for these schools, assisted in the procurement of their civilian personnel, worked directly with the school personnel following the establishment of the schools, and continues to observe the schools' progress and to study and evaluate recommendations for modifications in the curricula.

Another example is that of the reserve officer candidate program to begin in the summer of 1949. The section has prepared the curriculum and a representative will be present at each of the two schools to assist instructors and to observe and evaluate instruction during the course.

Field instructor training is done in all types of schools, ranging from the postgraduate level to recruit training.

Publications: The section is not primarily concerned with the preparation of publications other than curricula since that is the mission of the publications section of the branch. However, a few publications directly connected with education and training procedures are prepared by the curriculum and instructor training section. Among these are *The Shipboard Training Manual; The Manual for Navy Instructors;* the officers' correspondence course, *Education and Training;* and publications dealing with leadership.

The Shipboard Training Manual was requested by the chief of naval operations. The book was written and published chapter by chapter in the *U. S. Naval Training Bulletin* for comment by the fleet. These comments in turn were used in a modification of the book so that upon its publication it has been generally accepted by operating ships.

The Manual for Navy Instructors was written during the war at which time there was a need for a very small book dealing with simple techniques. Since then the publication has been revised a number of times and includes much material not included in the first edition. This publication attempts to describe in detail all of the practical procedures useful to instructors whether they be regular navy, naval reserve, technical or nontechnical, officer or enlisted.

Instruction Sheets: Certain experimental work is being done in the field of instruction sheet preparation. It has long been recognized by vocational and technical schools that students progress much faster, learn more accurately, and remember longer if they are provided with well-written and illustrated sheets or pamphlets on each lesson or phase of their training as they go along. These sheets are generally written so that a student may follow them in a step-by-step fashion as he practices new skills or procedures. At the present time a set of detailed instruction sheets on the oscilloscope are in preparation. When ready these sheets should provide the very finest in written instructions for student use in shops and laboratories during the training period.

Related Activities: Since the section is concerned with training in its broadest aspect, it is frequently called upon to assist with jobs not normally thought of as either instructor training or curriculum work. For instance, the need for achievements tests for use in developing tests is very apparent in the entire navy training program. Educators in this section have set forth procedures for preparing a practical and comprehensive testing program for the navy.

Another example of the related work done by the section is that of the experiment in training through the use of television. At this time the navy is experimenting with this new medium. Certain units of instruction are being sent from Sands Point, Long Island, to the Maritime Academy at Kings Point, Long Island, and research is being conducted by Fordham University and this section to judge the effectiveness of certain methods that may be employed with television and to explore the usefulness of the device for certain conditions such as would exist during mobilization.

Electronics Experiment: A third illustration is the experimental program in the teaching of electronics. At present electronics has been taught by having lectures and demonstrations presented by members of the teaching staff followed by shop periods usually under a different instructor. The present experiment is built around the idea of having one instructor stay with his class during their entire training period. Instruction would be given in a combination shop and classroom, so that related instruction could be provided in small amounts just as it is needed, rather than in long lectures several hours or days prior to the shop period. This will, of course, tend to increase the instructional load of individual instructors, but it is contemplated that this disadvantage will be more than offset by the instructors feeling more responsible for the success of their students and will facilitate the recognition of different rates of learning within the group. Thus, the slow student or the one who is having difficulty on a problem can be given the individual attention of the instructor almost immediately. The experiment is to be tried by a small group and expanded to other electronics training programs if it proves successful.

Personnel of the Curriculum and Instructor Training Section: Members of this section are civil service employees selected for their positions on the basis of their qualifications for high level educational work. In addition to the requirement of having varied and extensive teaching and supervising experience, each specialist must be able to work intelligently in a specific area of navy training, such as ordnance, electronics, or engineering. Almost all members of the section are naval reserve officers and several are active in the organized naval reserve training program.

Throughout each year a number of educators who hold naval reserve commissions come to the section on the authorized annual 14-day training duty. This arrangement promotes productive co-operation between personnel in the navy's instructor training program and civilian educators from all types of training programs.

Conclusion

The present navy instructor training program, based as it is on several years of growth and development, and supported by the best that civilian education can bring to the navy, and the understanding and assistance of the navy training organization, continues to fulfill its mission in an increasingly practical manner. It has been thoroughly demonstrated that the training of instructors is one of the most worth-while expenditures of time and energy. Through the adequate training of naval personnel as instructors, the quality of instruction is improved, the quality of output from our schools is made more useful to the fleet, and the whole naval establishment is more capable of performing its job now and in the case of another emergency.

Personnel of the Curriculum and Instructor Training Section as of May, 1949

PERS 411 — Homer C. Rose is the section head of the curriculum and instructor training section. To accept this position under Civil Service, Mr. Rose was released from active duty as a lieutenant commander in May, 1946.

During the early phases of the war, he was employed by the army at Fort Knox, Ky., in one of the first major instructor training programs for the military service. Following this, he was trained as an enlisted man in the army and was released in 1944 to accept a commission in the navy. As a naval officer he organized instructor training programs principally with the Amphibious Training Command, Atlantic Fleet.

Prior to the war, as a member of the faculty at Southern Illinois University, Mr. Rose trained teachers for the field of industrial education.

PERS 411a — J. B. Mitchell was assigned to various training billets during the war; he was officer in charge of a harbor defense school at NTC (Harbor Defense), San Pedro, Calif., and also served as head of the department of mathematics at the Naval Academy Preparatory School. He brings to the training activity several years' experience in public school administration and college training.

PERS 4112 — O. W. Margrave served in the navy as instructor and administrator in gunnery training, and in the Fleet Maintenance Division (Fire Control Section) in the Bureau of Ordnance. He was employed in college teaching before the war. Dr. Margrave was on leave until July, 1949, to act as head of the Training Manual Division, Naval Reserve Training, Publications Project, Washington, D. C.

PERS 4113 — Michael B. Callahan served with the Amphibious Forces as an instructor training aids officer and officer in charge of a unit which produced training aids for amphibious training. He was previously employed as a training specialist, training aids specialist, and training administrator with the Army Air Forces and the Civilian Conservation Corps.

PERS 4114 — B. H. Moran is a mechanical engineer who has had civilian experience both in engineering and in college teaching in the fields of physics and mathematics. He served in the navy as a curriculum specialist at BuPers and in executive and instructor training capacities in various schools and district headquarters.

PERS 4115 — H. O. Johnson served in the navy as a member of the training activity, BuPers, specializing in electrical and electronics phases. Previous to his naval duty he was employed by the AAF Technical Training Command as a technical and educational adviser. He has a background of public school and college teaching.

PERS 4116 — John C. Lang organized and was officer in charge of the instructor training program at the NTC (Service School Command), Farragut, Idaho. He was later executive officer to the director of training in the 14th naval district. His civilian experience included public school administration supervision, and teaching in distributive education.

PERS 4116a — W. D. Musser has eight years of instructional experience in civilian education and for five years he was with the U. S. Office of Education as administrative assistant in the office of the Director of Trade and Industrial War Training. He wrote the history of the World War II Training Program for War Production Workers for the U. S. Office of Education.

PERS 4117 — Harvey G. Bergner served as instructor training officer in the First Naval District Training Office. His civilian experience included 5 years in industry, and 22 years in the teaching and supervision of vocational, high school, and adult education classes in Wisconsin.

PERS 4118 — Amel D. Taul served in the navy as an Instructor Training Officer in the Service Schools at Great Lakes, Ill., during World War II. Prior to accepting a commission in the naval reserve he was a technical and educational adviser in the electronics training program with the Army Air Forces Technical Training Command. His civilian experiences also include administration supervision, and teaching in public schools; and counseling World War II veterans for the Veterans Administration.

PERS 4119 — William K. Penn served in the navy as a gunnery officer assigned command of navy gun crews aboard merchant ships. During a later period he was assigned as instructor of celestial navigation for officer classes at the Armed Guard Center, New Orleans, La. Prior to accepting a commission in the naval reserve, he was with the State Board of Vocational and Adult Education in Wisconsin as a co-ordinator and supervisor of training at the community level.

Problems and Projects

METAL PLAYGROUND SWING

C. C. ADAMS
Industrial Arts and Vocational Education Instructor
High School
Barberton, Ohio

A successful attempt at utilizing the industrial and vocational departments now functioning at Barberton High School was made, when it became apparent that the facilities at our command were extensive and flexible enough to serve, not only the educational system, but the community as well.

The students, having acquired a working knowledge of welding, were anxious to display their skill, under supervision, in the production of playground equipment. Then too, civic pride and the knowledge that they were performing service, not only to the youth of today but for those who would follow, made the job still more appealing to them.

Therefore, through the combined efforts of Superintendent Crewson, the board of education, and the city officials, school grounds, public parks, and playgrounds have been supplied with the type of swing shown in Figure 1, which uses four swings to each unit.

These swings can be varied to meet the needs of age, weight, and height of the children to be considered.

Fig. 1. General view of the whole unit

Materials for the swings were then studied from the standpoint of economy and adaptation. The first material studied was angle iron; the cost was found to be prohibitive, and the strength of the material doubtful, for these particular stresses.

It is a known fact that a hollow tube possesses greater strength than a solid cylinder or bar having the same amount of metal. Therefore, pipe was chosen as it seemed to answer the question of strength and availability.

It is also true that 1½-in. pipe slips closely into a 2-in. pipe, and that 2½-in. pipe fits closely into 3-in. pipe.

For a swing unit, 8 pieces 6 in. in length must be first welded to the top rail of the swing. This cutting should, of course, be done by the use of templates, to establish the proper angles, shown in Figure 2.

The cutting may be done with hacksaw, power saw, or shaped in a shaper. The pieces must then be ground to fit the pipe closely, to facilitate the welding.

The welding can be either arc or oxy-acetylene; we used both methods to give variety to the work.

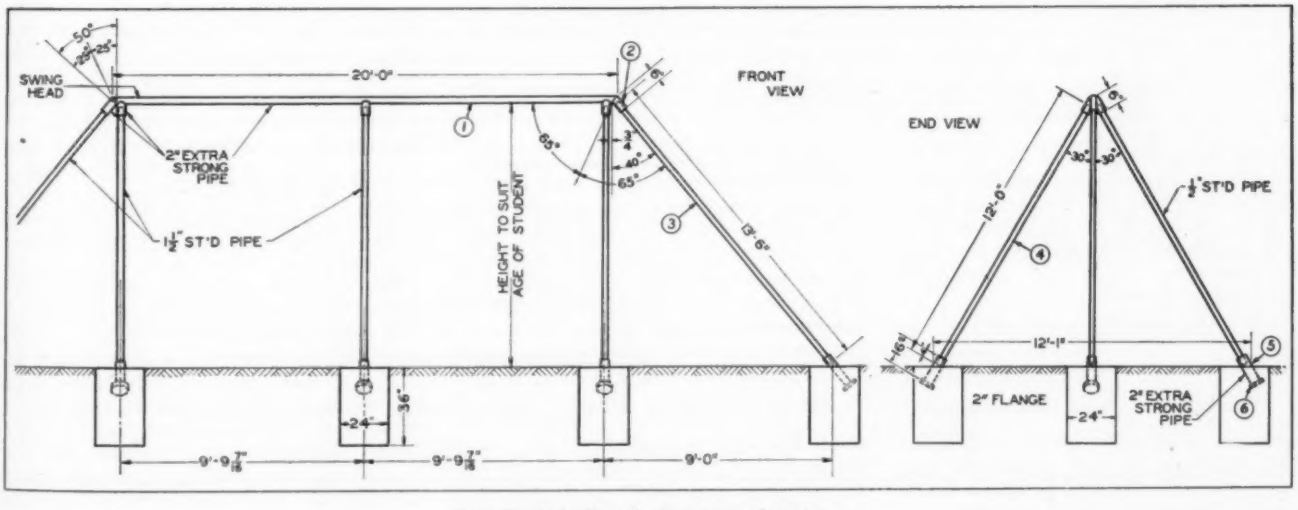


Fig. 2. Details of playground swing

In the lighter swing head, we used 2-in. pipe for the headpieces, and 1½-in. pipe for the uprights; in the heavier swings, 3-in. pipe for the headpieces, and 2½-in. pipe for the uprights.

It has been our experience that the larger pipe gives greater satisfaction than the smaller pipe.

The uprights slip easily into the headpiece, and are bolted in with ½-in. bolts; they also slip into the flanged pieces, which have been placed in a concrete base, and again bolted to the base pieces.

All drilling should be done before any welding is attempted; all holes should be drilled and centered straight through the pipe, thus eliminating any difficulty in the final assembly of the swings.

In making the templates, establish the proper angles to assure regularity. The templates should be of 16-gauge metal, and large enough to slip over the pipe, thus facilitating the cutting.

The swing head, thus constructed, will accommodate two swings on each half of the head.

The chains used were for standard swings, and made to clamp on the head of the swing; they were constructed to rock on a ¾-in. steel ball. All that is necessary, of course, is to keep these well greased.

The seats should be of hardwood, reinforced with metal strips, bolted at each end of seat, to prevent splitting. The width of the seats should be the same as that used on standard swings. Frames and swings should be then given a suitable finish.

Penetration is of the utmost importance in all of the welds made.

BILL OF MATERIALS

No. of pieces	*Name*	*Size*
1	Head	2 in. x 20 ft.
8	End pieces	2 in. x 6 in.
2	End legs	1½ in. x 13½ ft.
6	Side legs	1½ in. x 12 ft.
8	Foot pieces	2 in. x 16 in.
8	Flange unions for 2 or 3-in. pipe	
8	16-in. pieces should be threaded to screw into the flanges	

Specifications

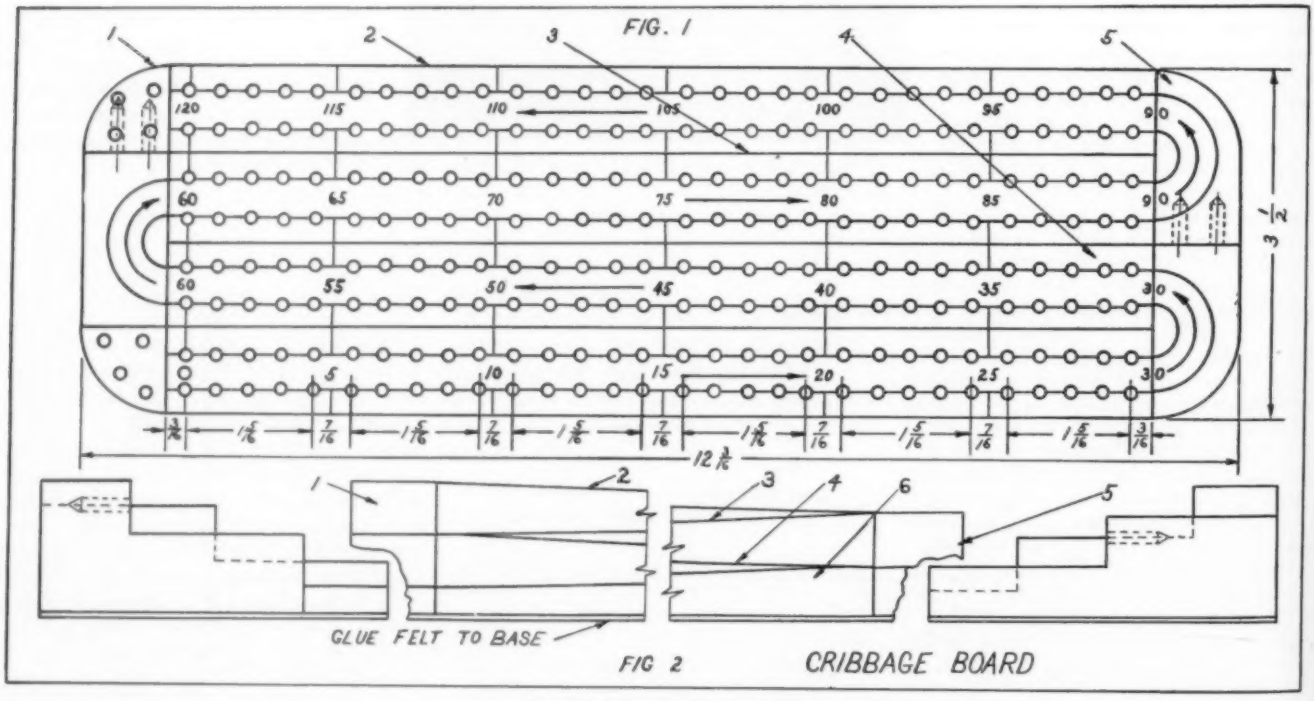
1. All 1½-in. pipe will slip into a 2-in. pipe, and 2½-in. pipe will slip into 3-in. pipe.
2. The head or top of the swing should be made of 2-in. extra strong pipe and the legs of the swing should be made of 1½-in. pipe.
3. The selection of pipe is of great importance because the age, size, and weight of children should determine the gauge of pipe.
4. If 3-in. pipe is selected, the legs will necessarily need to be 2½-in. pipe.
5. It should be remembered that pipe lengths approximate 20 ft. in length. One should buy pipe so that the proper lengths for the parts of the swings may be obtained.
6. Eight pieces of pipe should be cut the same size as the head of the swing. These should be 6 in. long.
7. Templates should be made so that the proper angles can be made while cutting the pieces for the ends before they are welded on the head pipe.
8. The templates should be made of 16-gauge metal so that they will fit over the ends of the pipe freely.
9. Templates should be made for both sizes of pipe, that is, for either 2 or 3-in. size.
10. The eight 16-in. pieces should be threaded on one end so that they can be screwed into the flanges.
11. The flanged pieces are necessary to fasten the swings to the ground.
12. The cement bases in which the flanged pieces are embedded should be 2 ft. square and long enough to take them below the frost line.
13. The flanged pieces should project about 4 in. above the ground, or enough to allow room for bolts for fastening the uprights.
14. The uprights should be bolted to the headpiece with ½-in. bolts.
15. The angle of the center legs is the same as the end leg angle.
16. The angle of the head and the end leg is 65 deg.
17. The angle of the side legs is 30 deg.

CRIBBAGE BOARD

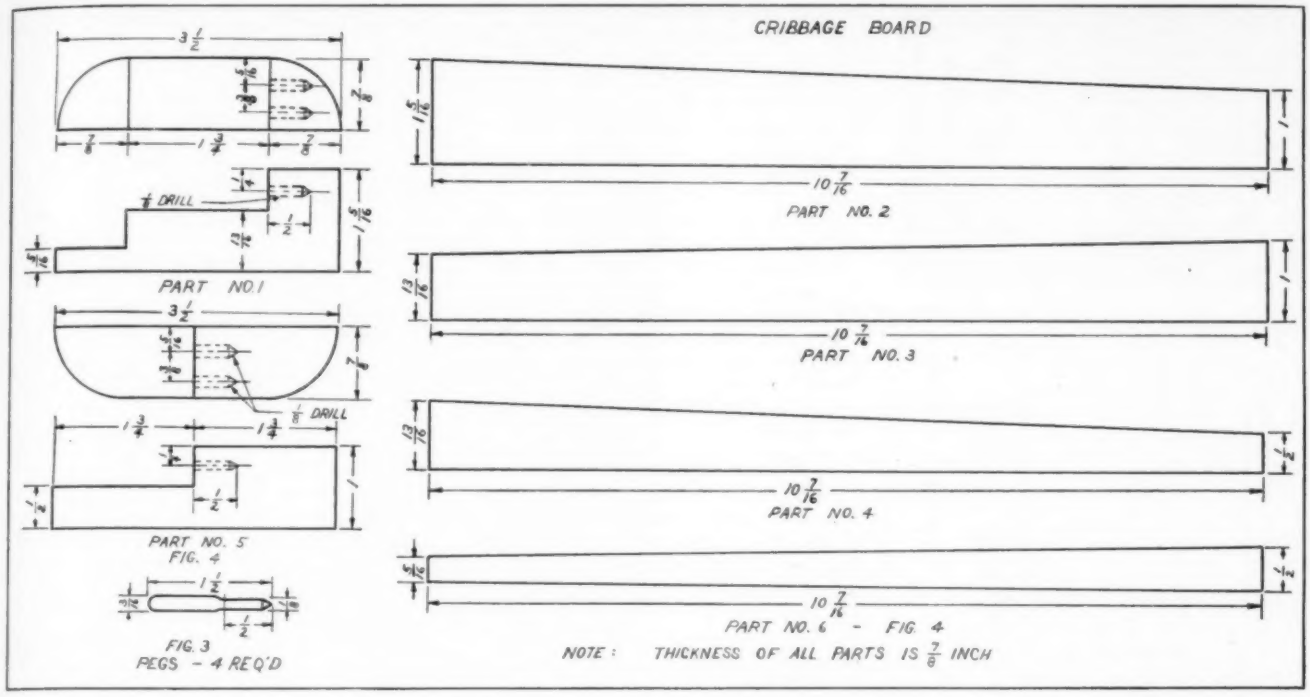
E. A. RERUCHA
River Grove, Ill.

If you are a cribbage player and sometimes get confused pegging the score properly on the conventional scoreboard, here is a design for a board which will eliminate the confusion. The pegging is done on an inclined hole track as the score progresses and the direction is marked.

The board is made from light-colored hardwood such as maple or birch, and consists of six parts glued together as shown in Figure 1. Each part is numbered and the detail dimensions for each part are shown in the drawings of each individual piece in Figure 4. All pieces are ⅞ in. thick. Start by cutting



Figs. 1 and 2. Cribbage board



Figs. 3 and 4. Details of cribbage board

out each part and plane and sand accurately the top, sides, and bottom. Glue the long pieces of the middle section together, placing them in their proper positions as shown in Figure 5. When the glue has set, sand the ends smooth and even and attach the endpieces, parts Nos. 1 and 5, using No. 6 finishing nails and glue. Drill pilot holes in both the ends and the middle section of the board. Use a 5/32-in. drill for the pilot holes. With a 1/8-in. drill enlarge the holes in the outer side of the endpieces to a depth of about 1/4-in. so that the heads of the nails may be driven under the surface with a nail set. Fill the holes with plastic wood. In drilling the pilot holes it is suggested that the holes are first drilled in the endpieces so that they are opposite the center of the end of each of the pieces in the middle section, that is, parts Nos. 2, 3, 4, and 6. Then place the ends in position and mark the position of the holes by inserting a nail in each hole and tapping it with a hammer so that the point marks the exact location of the hole.

To lay out the location of the peg holes a templet should first be made and then successively placed on each track and the center of each hole located with a sharp point. The dimensions for spacing the holes are shown in Figure 1. First mark and lay out the spaces. Then divide the 1 5/16-in. space into four equal parts to locate the holes. Drill the holes with a 1/8-in. drill to a depth of 1/4-in.

The track lines from hole to hole and the dividing lines between each group of five holes are made by applying paint or enamel with a ruling pen. Use a different color for each of the lines, as for example, black and white for the track lines and red for the short dividing lines. After the holes are drilled and before the lines are put on, the peg hole surfaces should be given a coat of shellac. When dry, sand smooth with fine sandpaper to remove the glazed surface of the shellac. Letter on the tally numbers with a pen using black drawing ink. Then put on the lines with the ruling pen. Finish the board by sanding the bottom and slightly round all edges. Then apply two coats of clear varnish. A piece of felt is glued to the bottom and the edges trimmed when the glue has dried.

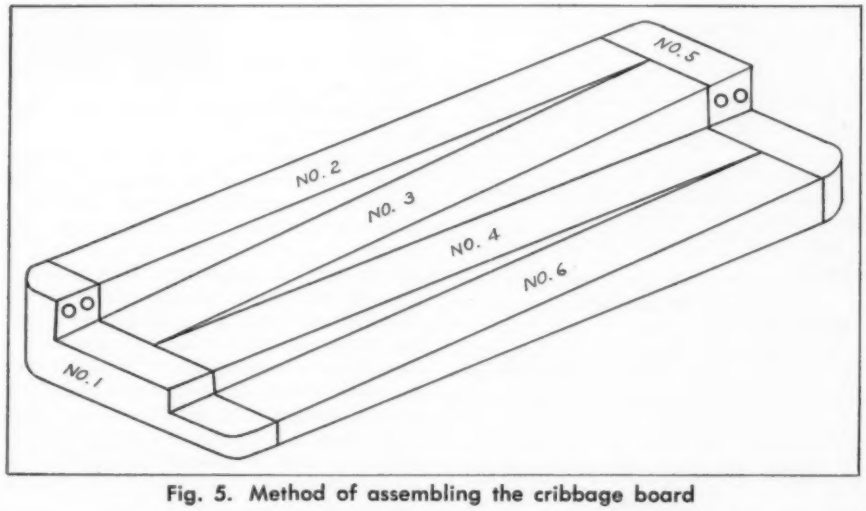


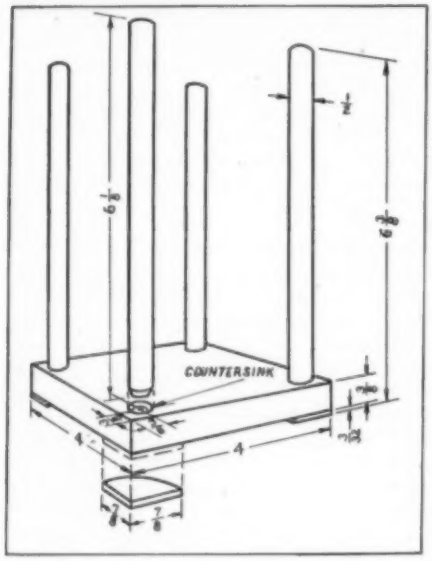
Fig. 5. Method of assembling the cribbage board

The pegs are made from a piece of dowel rod. Place the rod in a drill press chuck and form with a file. Then sand them smooth. Paint the tops of each pair of pegs to correspond to the track colors. Two 1/8-in. diameter horizontal holes are provided in each end of the board in which the pegs are stored when the board is not in use. The pegs are thus protected as they do not project above the surface.

PLASTIC CUP RACK

JOHN R. POSTMAN
Columbus, Mo.

This is a project which offers elementary hand and simple machine operations useful in the working of plastics. The cup rack is inexpensive, simple to make, and useful in



Cup holder

the home. Operations included are layout, cutting, filing, overlaying, cementing, buffing and polishing, and making friction joints with a drill press. The material used was clear Plexiglas.

BILL OF MATERIAL

No. of pieces	*Part*	*Size*
1	Base	⅜ x 4 x 4 in.
4	Feet	3/32 x ⅞ x ⅞ in.
4	Rods	½ dia. x 6⅛ in.

HOW TO CREATE NOVELTY LAMPS

ROBERT L. WOODWARD
Instructor of Electricity
Junior High School
North Hollywood, Calif.

Fabricating electric table lamps from glass, porcelain, or pottery has great "take home" value. Many of the parents, without the writer requesting, supplied their sons with second and third articles to be converted into lamps. During "Public School's Week" visitors to the school showed keen interest in the student lamp exhibit. Upon invitation, the showcase windows of the local Chamber of Commerce were used for a period of two weeks for a public display of these lamps. The area newspaper devoted eighteen column inches to photographs and a story of this display.

By making use of the following problem-solving procedures you, as the instructor, will be in a position to offer your students an opportunity to:

1. Design and create "individualistic" articles;
2. Make items having both personal and monetary value;
3. Construct lamps that will make beautiful and useful gifts;
4. Acquire the "professional touch" by simple techniques;
5. Functionally learn to wire and repair electric lamps.

The following instructions are directed to the students.

How to Select the Lamp Body

Hunt for the unusual. You can create an attractive lamp from hobnailed perfume bottles, after-shaving lotion jugs, odd-shaped beverage bottles, porcelain and pottery jugs and vases, teapots, drinking glasses, urns, etc. Rummage through your home and neighborhood for an unusual article that could serve as the body of a lamp. The quality and value of your completed lamp depends upon the thought you put into the selection of your lamp standard. Figure 1 shows a variety of ideas for lamps.

Consider color. Choose a lamp standard that has a coloring which will harmonize with the room in which you intend to place it. When using glass for the standard it is best to select colored glass (amber, brown, green, blue, or frosted white).

Choose style. Select your style of lamp from the three types of standards shown in Figure 2. (1) *Standard with base* shown at *A* in Figure 2. Slender bottles, vases, and jugs would tend to make lamp top-heavy so you should use a wooden base. Drill one hole through the bottom of this standard. (2) *Standard with cork.* See *B,* in Figure 2. Jugs, demijohns, and heavy vases do not need a base. Shape a wooden cork to fit in the neck. Drill one hole in the side of the lamp body near the bottom. (3) *Standard without base or cork* shown at *C* in Figure 2. Large types of standards with a concave bottom can be assembled by drilling a hole in the bottom and one in the side.

How to Drill Holes in Glass, Porcelain, or Pottery

Clamp article. Secure object to be bored in proper position on drill-press stand with wood clamps. Care should be taken to avoid too great a pressure by the clamps upon the article.

Insert drill. Place a 6-in. length of ⅛-in. (hollow) brass pipe in the chuck of the drill press.

Apply abrasive. Put a small quantity of carborundum grains (No. 60) on the surface of the article where the hole is to be drilled. If the surface is curved form a small sump with putty to hold the carborundum.

Keep cool. Apply turpentine, at intervals, to the area being drilled. Keep a small amount of turpentine at this point during the entire drilling process.

Operate drill press. Ascertain that drill (pipe) will bore at planned location. Turn on drill press. Bore by grinding carborundum into object. Release the drill from the article at intervals to keep cool and to allow the carborundum and turpentine to flow into the starting of the hole. *Remember:* Do not force the drill. Raise the drill frequently. It takes approximately 20 minutes to drill through a ¼-in. thickness of glass.

How to Decorate Stand

Make decision. The majority of lamp stands will not need additional decoration. Colored glass or glazed pottery are found to be most effective if left in their natural state. Untinted glass can be improved by the application of paint or decals.

Color interior (untinted glass). Be sure interior of bottle is dry. Pour in paint or enamel. Plug up opening(s). Shake until the inside surface is covered. Pour remainder of paint back into its original container.

Paint exterior. Some clear glass containers have designs on their external surfaces (decanters, cider jugs, etc.). These decorations can be improved by adding color to the designs. Hand-painted motifs, if well done, increase the quality of ordinary objects.

Assimilate candle wax. A gay effect can be added to your lamp by using bright colored enamels to give the appearance of candle wax runs. Apply on the neck of the bottle a few heavy strokes of brilliant-hued enamel. Allow this to run down the side of the bottle. Let dry. Apply the following coats in the same manner. *Remember:* Have colors harmonize, don't use too many colors and only apply small quantities of each.

How to Prepare Base

(To be used with standard like the one shown at A, in Figure 2.)

Cut shape. Decide on shape and size of your base. Make it balance with other parts of your lamp.

Smooth surfaces. File end grains smooth. Sand all surfaces.

Bore holes (See *A,* Fig. 2). Drill a ⅜-in. hole through center of base. Bore a 5/16-in. lamp cord hole through side of base to meet center hole. Countersink with ¾-in. drill on the bottom at the center.

Apply finish. Consider the type of wood you have selected and the general design of your lamp when applying a finish to your base.

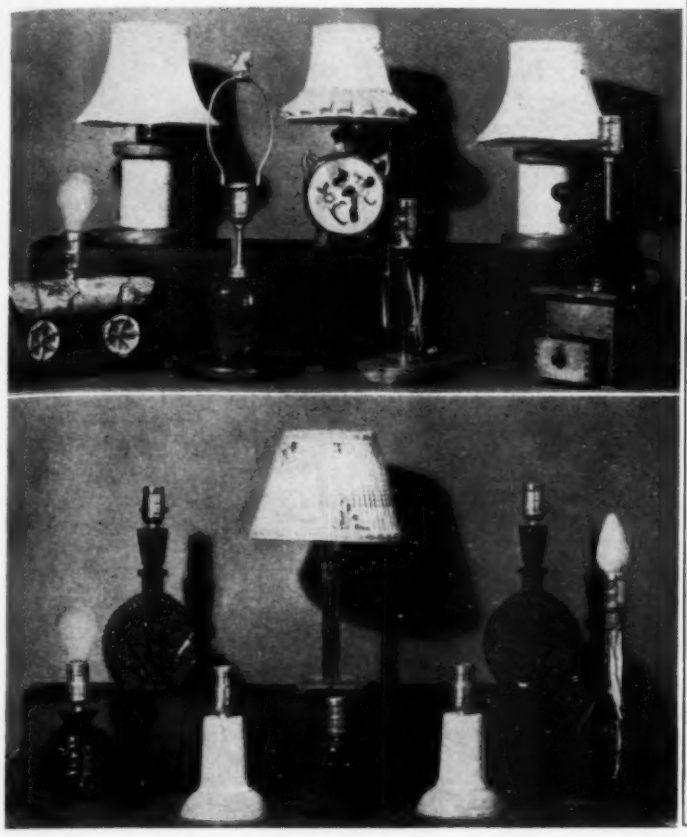
How to Shape Cork

(To be used with standard B, Fig. 2.)

Pick dowel. Select a piece of doweling a little larger in diameter than the neck of your bottle or jug. The length of the dowel will be determined by the length of the neck of your standard and how far you want it to extend above.

Drill hole. Bore a ⅜-in. hole lengthwise through the dowel.

Shape dowel. Place dowel in lathe chuck.



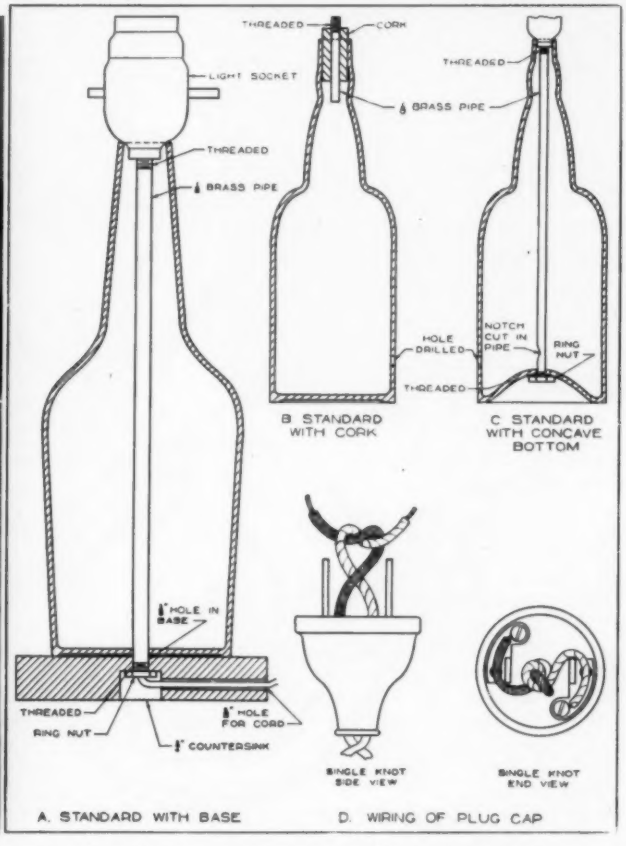


Fig. 1. (Left) The covered wagon lamp above, is made of yucca. Then there is one made out of a pottery lotion jug (note ornament on harp made from lotion jug stopper), tall straight-sided drinking glass, old-fashioned coffee grinder, tin cans wrapped with cotton rope (nautical style), glazed pottery flower vase, glass bowl, plastic drinking glasses and bowls, teapot, beverage bottle, cut glass decanters, and plastic. Fig. 2. A variety of novelty lamps. Drawing by Bernard R. Shaner

— Photographs by Robert W. Pease

Start lathe. File a slight taper on the dowel (the shape of the cork). Check for size at intervals.

Finish cork. Apply paint or enamel to the cork that will harmonize with your color scheme.

How to Ready the Pipe

Choose type of material. Use ⅛-in. iron pipe for body of lamp made of pottery, porcelain, or painted glass. Employ ⅛-in. brass pipe for standards made of glass or when pipe is to be exposed as a stem.

Check for length. Consider whether the pipe is to extend through the length of the standard, whether a base is to be used, and whether the socket will extend part way into the neck of the lamp body. Cut only a short length if a cork is to be used. Do not mar surface of brass pipe in the vise.

Thread pipe. Thread pipe with ⅛-in. die for a distance of ½ in. on each end. (It has been found that it is best to thread only one end of the pipe, apply ring nut, and temporarily assemble lamp to check exact length needed before threading the opposite end). Thread only one end of the short length of pipe used in the cork.

Cut notch (only used on standard type C, Fig. 2). Insert pipe into standard and check point along pipe which will match the hole in the side as shown in Drawing *C*. Cut notch in pipe at this point. File lips of notch smooth.

Polish tube. Polish the surface of the brass pipe with fine steel wool or on a buffer.

How to Assemble Parts

Make check. See that all parts are ready for assembling and that paint is dry.

Put together. Assemble your particular type of standard as shown in Figure 2. Screw on lower section of light socket.

How to Wire Connections

Prepare cord as shown in Figure 2, at *D*. Measure a 6-ft. length of rubber-covered lamp cord. Split the double cord 1½ in. from *each* end. Bare the stranded wires ¾ in. from *each* end. Twist each of the stranded ends and solder. Feed cord through pipe.

Connect socket. Tie single knot as shown, or make an underwriter's knot. Twist in a clockwise direction, around the two screws on the lamp socket the two soldered wires on the end of the lamp cord. Tighten screws. Be sure wires and screws are insulated from outer socket shell and from each other. Press upper portion of light socket into place.

Wire plug (cap). Place cap over the cord. Tie single knot as illustrated. Form each of the soldered wires around their respective prong and to their respective screw. Twist the wires in a clockwise direction around the screws and tighten. Be sure there is not a short circuit before testing the lamp.

INDIAN SILVERSMITHING

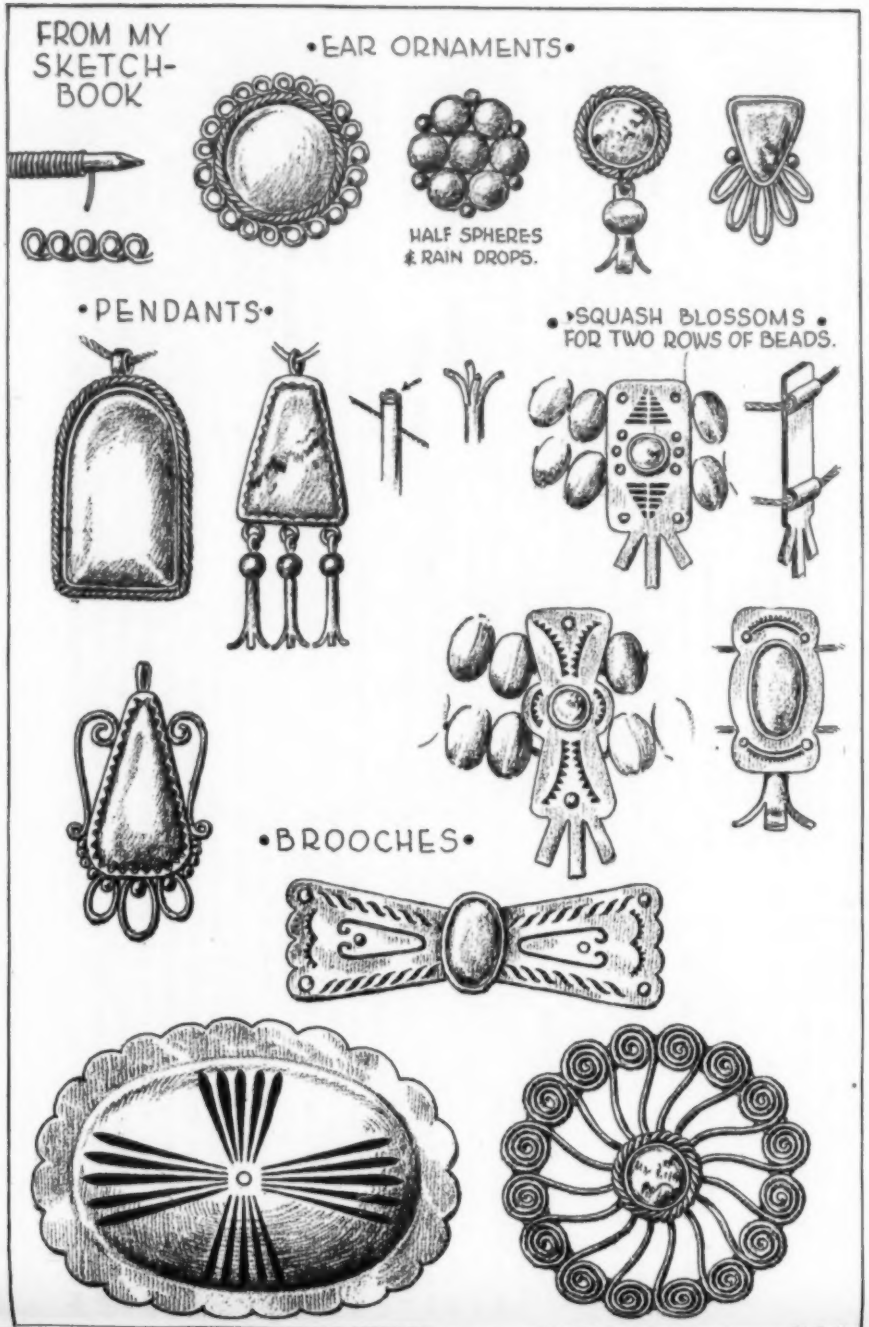
BEN HUNT

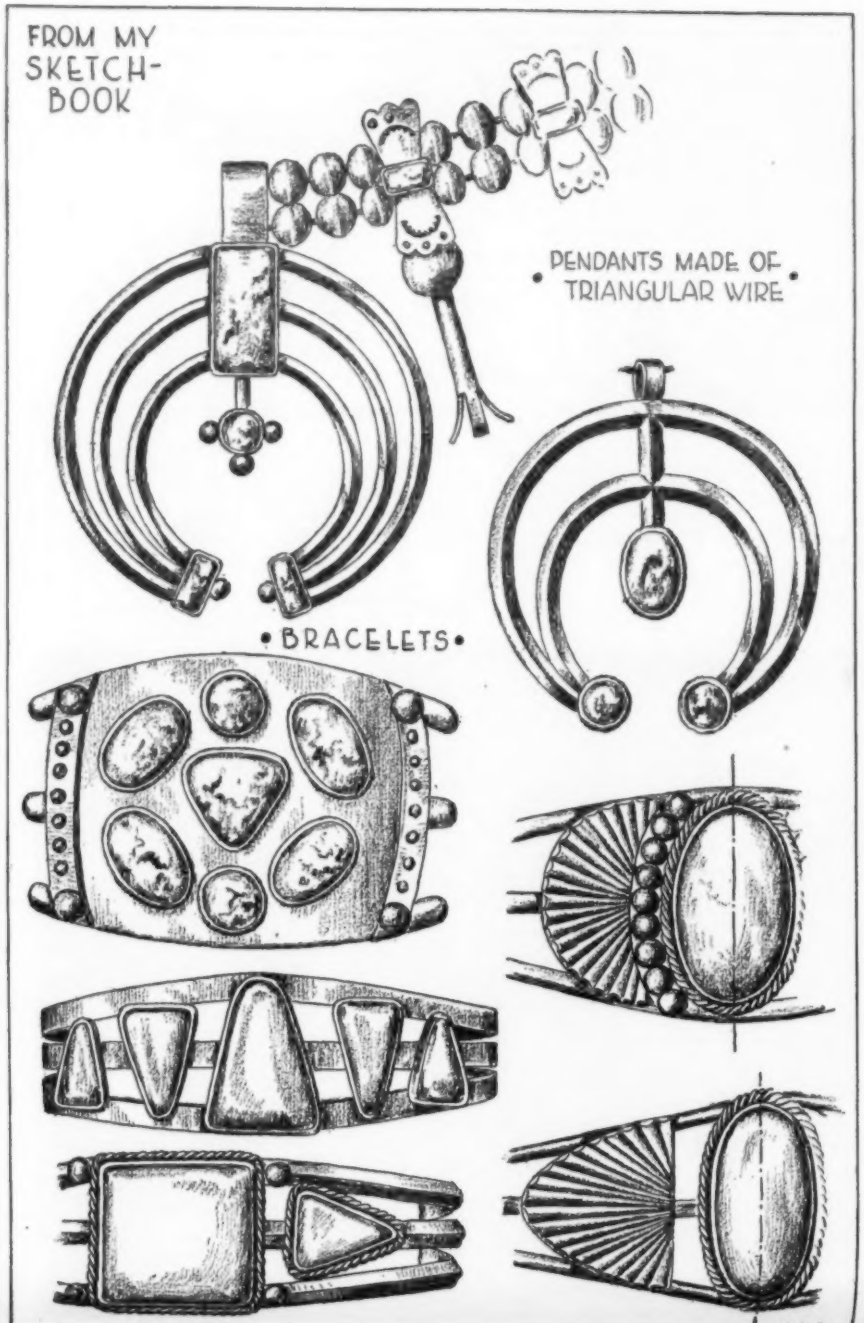
Hales Corners, Wis.

(Continued from page 420 of the December, 1949, issue)

Importance of the Sketchbook

In this, the last of the series of articles on Indian silversmithing, the author presents sketches of a few odd pieces from his sketchbooks. He hopes that they may be of interest to some of our readers. While many more projects could be added to those that have already appeared, it is felt that anyone who has made only a small number of the pieces shown previously, has acquired enough


FROM MY SKETCH-BOOK
•EAR ORNAMENTS•
HALF SPHERES & RAIN DROPS.
•PENDANTS•
•SQUASH BLOSSOMS• FOR TWO ROWS OF BEADS.
•BROOCHES•


FROM MY SKETCH-BOOK
• PENDANTS MADE OF TRIANGULAR WIRE •
•BRACELETS•

skill to make almost anything in the line of Indian silversmithing.

The articles that have appeared in this series will now be compiled, revised, and then put into a book to appear sometime next year. However, the articles that have been shown are only a very small percentage of what can be done in Indian silversmithing. For the past many years, the author has sketched almost every piece of Indian silver which he has seen. He has also photographed many of these pieces, and it is his personal opinion that the sketch is preferable to the photograph in most cases. In the first place, it is the most practical method of recording, and in the second place, in the sketch, details can be recorded that the camera cannot pick up. Plates 41 and 42 show sketches that the author has made in his wanderings.

The author suggests that the reader make a notebook, approximately 5 by 8 in., in which he may collect sketches or photographs of interesting pieces of Indian silversmithing. He warns against making the mistake of not sketching pieces that are ornamented with large stones, simply because there are no large pieces of the stone on hand at the moment. There may come a time when big enough pieces are available to make large adornments for his silver work and then he will be glad if sketches are on hand from which he can work. Then, too, he may get an idea from a larger piece that can be incorporated into a smaller design.

The reader also should be on the lookout for stamps, as there is no end of them and it is as much fun making them as it is using them. He will find that no matter how many he has, they will all come handy sooner or later. He should always keep several sizes of tool steel on hand for making special stamps.

For the benefit of those who are looking for sources of supplies, the following list is offered. It may be well to write these firms for catalogs that will come handy to the silversmith. It is true, the Indian gets along with a minimum of tools, but he does so only from necessity. As it is in every field, the possession of good tools and enough of them makes almost any type of work a pleasure.

TOOLS AND SUPPLIES

Boin Arts and Crafts Studios
10 DeHart Street
Morristown, N. J.
Brodhead-Garrett Co.
4560 E. 71st Street
Cleveland 5, Ohio
Metal Crafts Supply Co.
10 Thomas Street
Providence, R. I.
American Handicrafts Co., Inc.
45–49 So. Harrison Street
East Orange, N. J.
Grieger's
1633 E. Walnut Street
Pasadena 4, Calif.

SILVER AND SOLDERS

Handy and Harmon
82 Fulton Street
New York 7, N. Y.

See also: Brodhead-Garrett Co., Metal Crafts Supply Co., American Handicrafts Co., Inc. (under Tools and Supplies).

TURQUOISE

Western Gem & Jewel Co.
1470 South Robertson Blvd.
Los Angeles 35, Calif.
W. S. Kettering
1901 Lake Avenue
Pueblo, Colo.

LAPIDARY OUTFITS

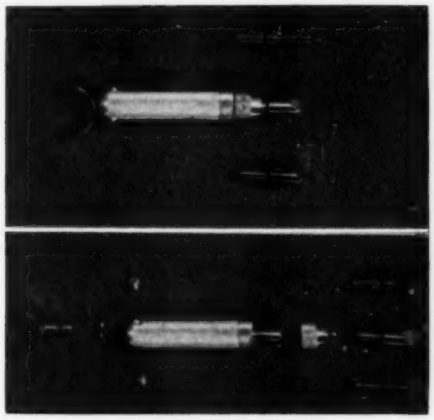
B. & I. Manufacturing Co.
461 Washington Street
Burlington, Wis.

LEATHERWORKING TOOL

F. LOWELL JACKSON and WILLIAM A. SELLON

Instructors of Industrial Education
The University of Oklahoma
Norman, Okla.

The leathercraft tool, described in this article, affords a very good intermediate machine-shop project from the viewpoint of both instructor and student. For the instructor it offers a medium by which many basic machine-shop operations may be demonstrated. For the student it affords practice in basic manipulative operations, and the finished product is a useful leatherworking tool. Several comprehensive shop teachers may make use of the project to supply needed leathercraft tools in their shops.



Swivel top cutter

The tool may be made of aluminum, stainless steel, or mild steel. Aluminum affords the best medium, because of its lightness; however, it should be 24ST or an alloy with similar properties of strength, to keep the threads from being stripped off with use.

In setting the work up on the lathe, either the chuck or collet may be used. The collet method is easier and quicker, but when the chuck is used, a great deal of practice in the accurate and careful chucking of stock is afforded.

The steel balls under the swivel make it turn easier. They may be taken from any small thrust bearing or ball bearing. They are not necessary, however, and if not available may be omitted by lengthening the swivel. The silver soldered joint between the swivel and the swivel top is preferable, but it may also be countersunk and riveted instead.

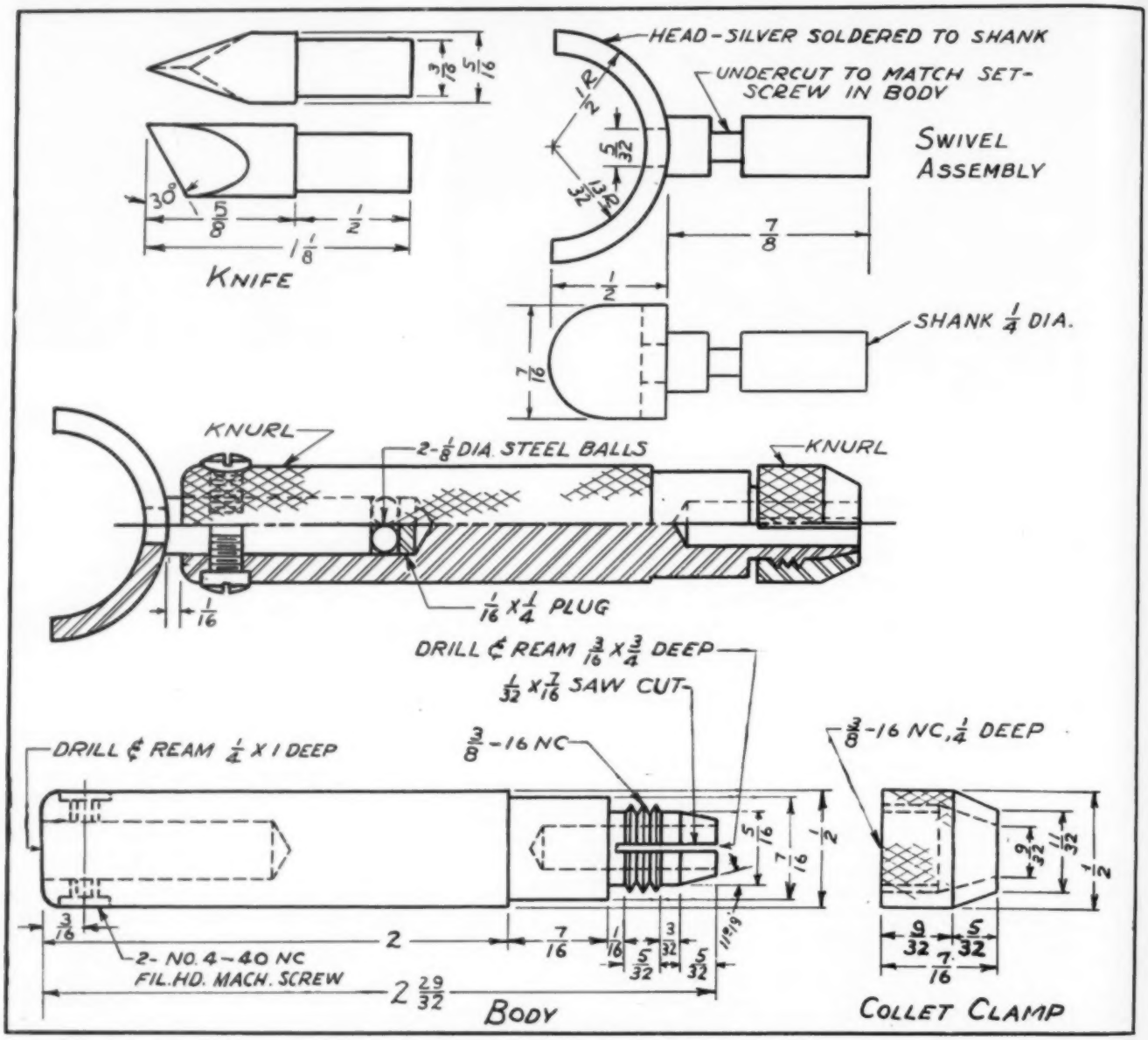
The picture shows two knives and a deer foot shading tool which may be made and used in the tool. Other tools such as modelers, ball points, and tracers may also be made to fit the collet.

The knife may be made by chucking $\frac{5}{16}$-in. diameter drill rod, turning it down to a $\frac{1}{4}$-in. diameter to fit the tool collet, then grinding the knife freehand on the tool grinder, after which the whole should be heat-treated.

Suggested Plan of Procedure

Body

1. Saw stock $3\frac{1}{2}$ in. long.
2. Chuck and center drill one end.
3. Turn $\frac{1}{2}$-in. diameter.
4. Turn $\frac{3}{8}$-in. diameter, $1\frac{5}{32}$ in. long.
5. Turn $\frac{5}{16}$ by $\frac{1}{16}$-in. undercut.
6. Cut $\frac{3}{8}$ in. 16 N.C. thread.
7. Set compound rest at 11 deg. 19 min., and turn taper.
8. Knurl.
9. Drill and ream $\frac{3}{16}$-in. diameter hole 1 in. deep.
10. Cut off to $2\frac{29}{32}$ in. in length.
11. Chuck opposite end (wrap part in aluminum strip to prevent damage to knurl).
12. Chuck and center drill opposite end.
13. Drill $\frac{15}{64}$-in. diameter hole 1 in. deep.



Details of swivel top cutter

14. Ream hole ¼ in.
15. Cut 1/32-in. slot 7/16 in. deep (may be done with either jeweler's saw or hack saw).

Collet Clamp

1. Chuck ⅝-in. diameter stock and center drill.
2. Cut to ½-in. diameter.
3. Knurl.
4. Drill 5/16 in. and tap ⅜ N.C. ¼ in. deep (use plug and bottoming tap to prevent injury to end of taper).
5. Cut ½ in. in length.
6. Chuck piece of ½-in. diameter scrap stock.
7. Cut ⅜ in. 16 N.C. thread ¼ in. long.
8. Screw collet clamp on.
9. Drill 7/32-in. hole.
10. Bore inside taper.
11. Turn outside taper.
12. Face end.

Swivel Top

1. Chuck 1-in. diameter stock.
2. Center drill.
3. Drill 29/32-in. hole 1 in. deep.
4. Ream to 13/16 in.
5. Cut off 7/16 in. in length.
6. Cut bushing in two pieces.
7. Drill 5/32-in. hole 90 deg. to the sawed ends.
8. File 7/32-in. radius on top.
9. Polish.

Swivel

1. Chuck 5/16-in. diameter stock.
2. Center drill and turn ¼-in. diameter 1 in. in length.
3. Turn 9/32-in. diameter 3/32 in. in length to fit swivel top.
4. Assemble in body after steel balls have been placed into ¼-in. diameter hole.
5. Locate 4-40 screw holes 3/16 in. from the end of the body and drill No. 43 through body and start drill into ¼-in. diameter.
6. This locates undercut on swivel for both 4-40 screws.
7. Drill No. 43 through body.
8. Tap 4-40.
9. Cut and fit undercut in swivel.
10. Rivet or silver solder to swivel top.

BACK YARD PICNIC TABLE

LELAND STROMBOM

Industrial Arts Department

Sycamore, Ill.

The table described in this article was designed by the industrial-arts department of the Sycamore Community High School, Sycamore, Ill. Considerable experimenting was done to finally arrive at a design that seemed to incorporate the following factors:

1. *Cost*: Due to the combined use of steel and wood the cost can be cut, because salvaged materials found in many homes can be utilized.

2. *Durability*: Various tests were made so that the design of the table would prevent the table from tipping over when someone stands on the seats or on the top.

3. *Mobility*: This table can be taken apart easily by removing the bolts. This is advantageous for winter storage. Many nailed tables are cumbersome. A picnic table has to withstand great variations in weather. The bolt construction enables one to keep all joints tight, something that could not be done with nailed construction. In addition, this table is very light and can be moved around the yard easily.

4. *Curriculum Placement*: This table can be used as a project in a general-shop course or in a woodworking course. The operations involved are simple to master. It also lends itself to a combination project for two students. We always have in our classes some boys that cannot afford a project of this size. By assisting another boy they achieve some experience that accompanies larger projects.

Strap iron and angle iron can be secured in practically any junk yard. This cuts down the cost appreciably.

EDUCATIONAL ELECTRONICS

JOHN N. WILLMOTT,
ROBERT L. WHITTLE,
and THOMAS D. MINER

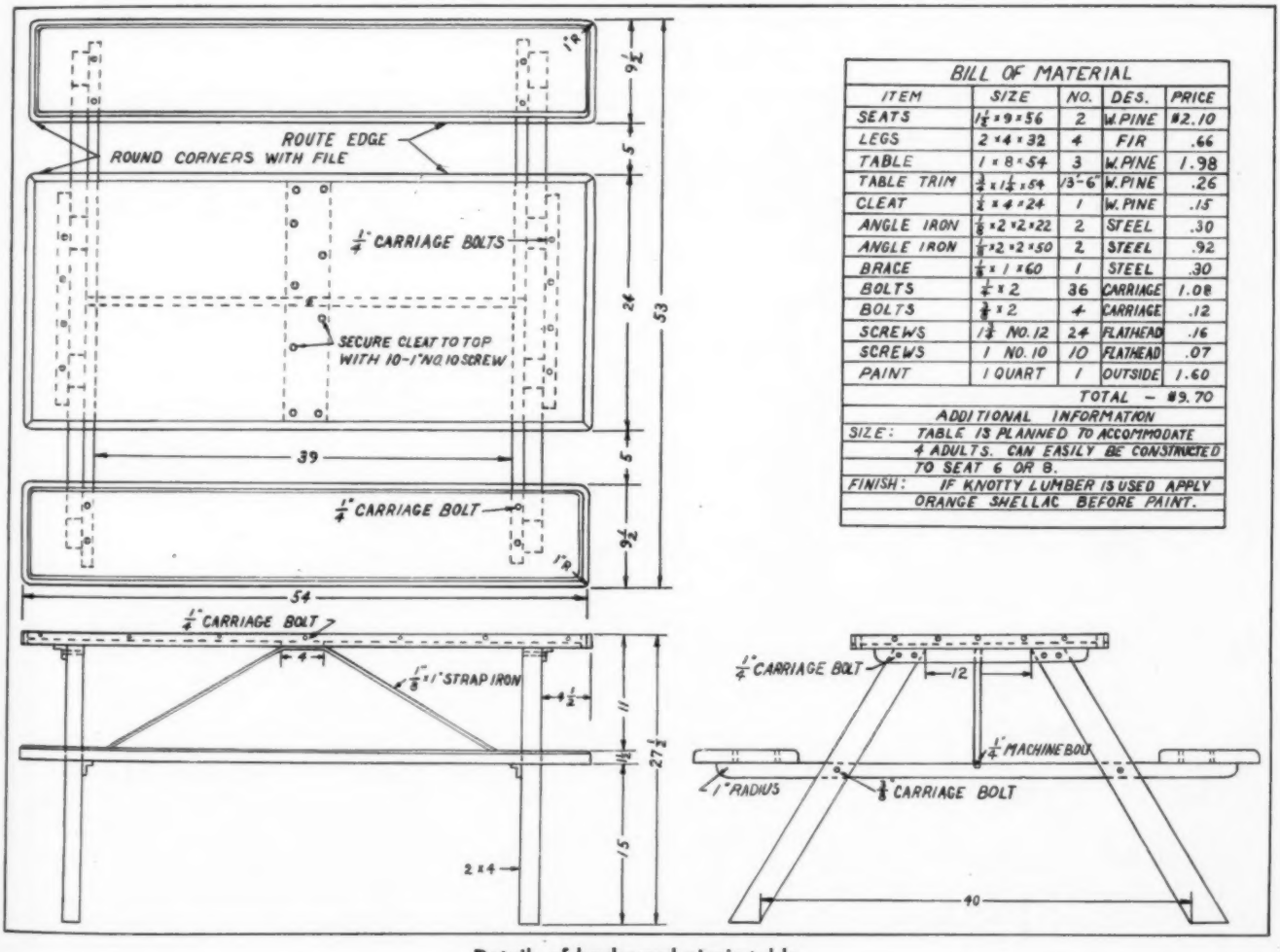
Public Schools
Garden City, N. Y.

(Continued from page 344 of the October, 1949, issue)

Unit No. 2 — The A.F. Amplifier

Check the following items in your kit:

2 — tube sockets, wafer, octal, laminated fiber, standard size
2 — transformers, output, 10,000 ohm prim. A3856 Stancor
1 — 1-megohm potentiometer IRC — D11 — 137
1 — knob for potentiometer 1¼ red bar
2 — 10.0 mfd., 25-volt electrolytic condensers
1 — .004 mfd., 400-volt tubular paper condenser
1 — .01 mfd., 400-volt tubular paper condenser, min. by-pass
1 — .00025 mfd., mica condenser
1 — 500,000 ohm resistor, ½ watt, fixed
1 — 500 ohm resistor, ½ watt, fixed
1 — 7500 ohm resistor, ½ watt, fixed
1 — double pole, double throw, toggle switch
1 — 6Q7-6T tube
1 — 6G6-6T tube
2 — loud-speakers, 5-in. p.m., Alnico
4 — spacers, ¾ by ¾ in.
28 — studs, "Nu-Way"
4 — r.h.b. wood screws, No. 6 by 1 in.
12 — r.h.b. wood screws, No. 6 by ½ in.
4 — machine screws, No. 6–32 by ½ in.
1 — grid cap with soldering lug
18 — connecting wires, Belden



BILL OF MATERIAL

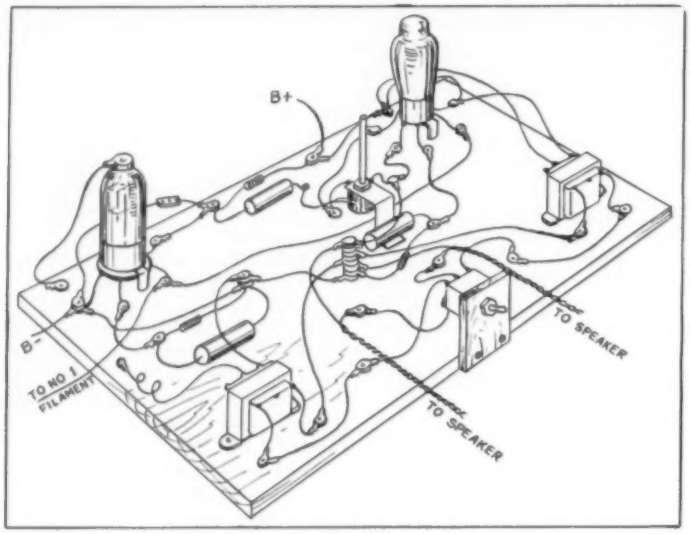
ITEM	SIZE	NO.	DES.	PRICE
SEATS	1½ x 9 x 56	2	W. PINE	$2.10
LEGS	2 x 4 x 32	4	FIR	.66
TABLE	1 x 8 x 54	3	W. PINE	1.98
TABLE TRIM	¾ x 1½ x 54	13'-6"	W. PINE	.26
CLEAT	¾ x 4 x 24	1	W. PINE	.15
ANGLE IRON	⅛ x 2 x 2 x 22	2	STEEL	.30
ANGLE IRON	⅛ x 2 x 2 x 50	2	STEEL	.92
BRACE	⅛ x 1 x 60	1	STEEL	.30
BOLTS	¼ x 2	36	CARRIAGE	1.08
BOLTS	¾ x 2	4	CARRIAGE	.12
SCREWS	1¾ NO. 12	24	FLATHEAD	.16
SCREWS	1 NO. 10	10	FLATHEAD	.07
PAINT	1 QUART	1	OUTSIDE	1.60
			TOTAL —	$9.70

ADDITIONAL INFORMATION

SIZE: TABLE IS PLANNED TO ACCOMMODATE 4 ADULTS. CAN EASILY BE CONSTRUCTED TO SEAT 6 OR 8.

FINISH: IF KNOTTY LUMBER IS USED APPLY ORANGE SHELLAC BEFORE PAINT.

Details of back yard picnic table



A.F. amplifier

2 — loud-speaker cords, Belden
37 — snap fasteners — "Nu-Way"

How to Build the Audio Amplifier

Read through before starting work.

1. Select one piece of wood ½ by 8 by 15 in., and two pieces 5 in. square. One-half inch fir plywood is suitable. Square, sand, and finish. Two coats of shellac rubbed with No. 3/0 steel wool is satisfactory.

2. Make the brackets to hold the potentiometer, the toggle switch, and the two loud-speakers. See the parts layout diagram.

3. Fasten the drilling schedule to the top of the board with tacks or tape. Referring to the parts placement diagram, place all the parts in their proper positions, and check to see that their holes line up with those on the drilling schedule. Due to stencil and paper inaccuracies, some of the holes may be slightly out of place. If so, take an awl, and locate the holes correctly. Using the drill sizes indicated on the schedule, drill through the board exactly as shown. Discard the paper drilling schedule.

4. Fasten the tube sockets, the transformers, and the brackets for the switch and the potentiometer with screws in the locations shown on the parts placement diagram. The tube sockets should be mounted with the No. 6 by 1-in. wood screws passing through the spacers provided. These spacers, or *stand-offs* are for the purpose of holding the socket and its connecting wires away from the board. Be sure that each socket is in position so that the keyway in its center hole is located as shown in the diagram. Put the potentiometer and switch each in its own bracket, and in the position shown on the diagram.

5. In an envelope you will find 28 studs. These are screws with ball-shaped ends, and a hexagonal head below the ball end. Remove the nuts, and screw in places indicated on the diagram. A hexagonal socket wrench to fit ¼-in. nuts such as the "Spintite" will make the job of tightening the screw studs easy. Do not tighten completely at this time, but leave enough clearance to draw wire under the head.

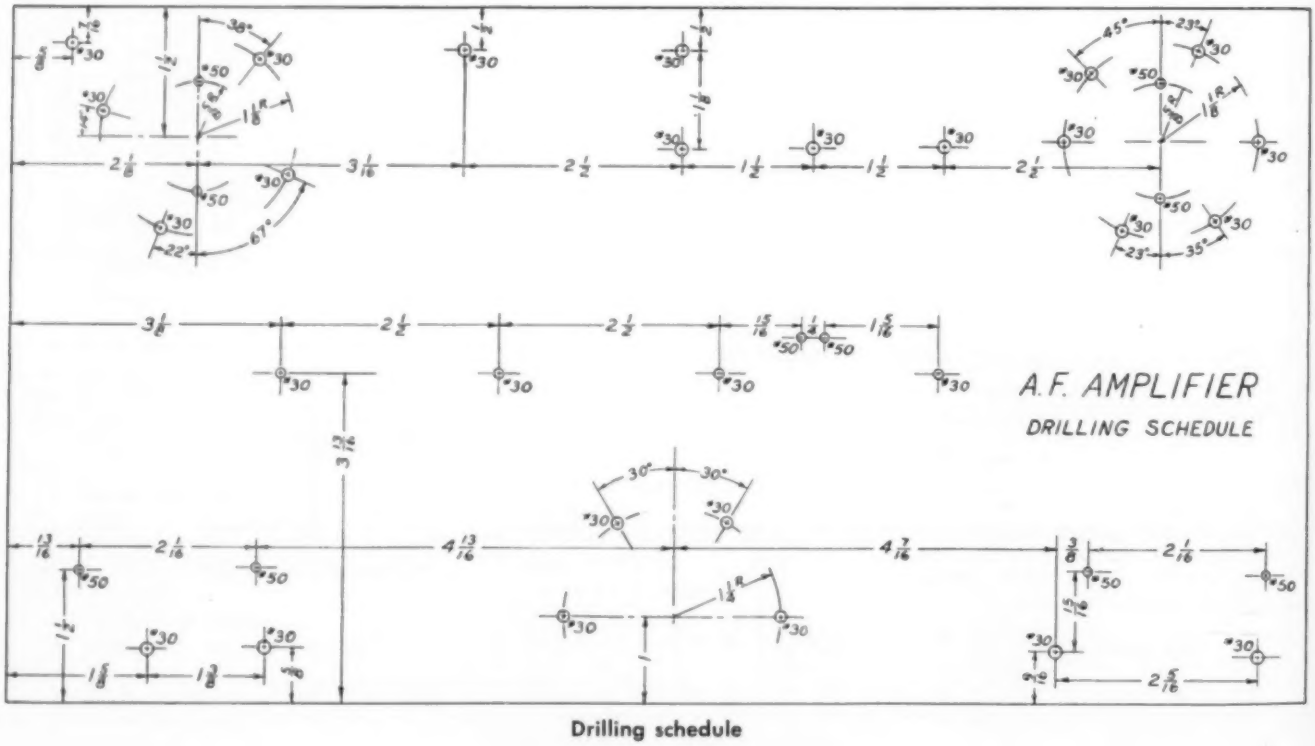
6. Refer now to the *wiring diagram*. Connect the wires from the tube sockets, the transformers, the potentiometer, and the switch to the proper studs by twisting them around the screw (clockwise) under the hexagonal head. Then tighten these studs.

7. Place the resistors and condensers in their places and connect each to its proper studs as shown in the wiring diagram.

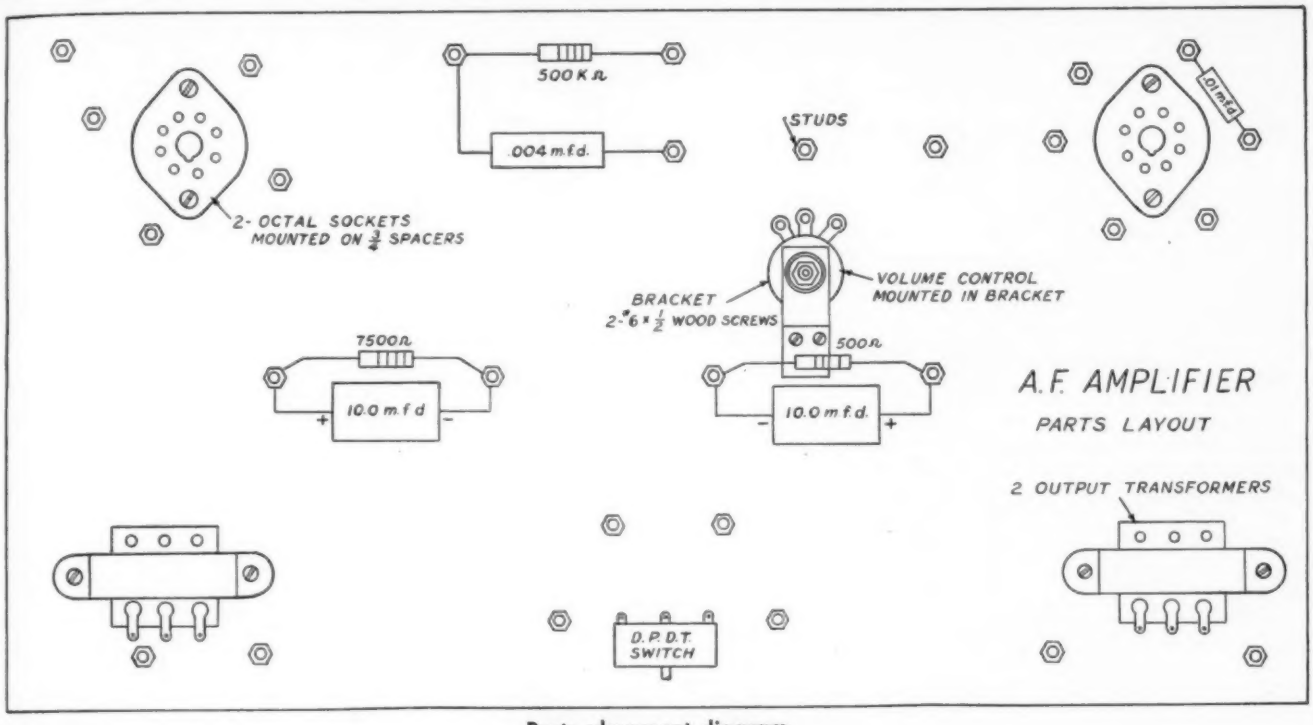
CAUTION: The two electrolytic condensers must be connected exactly as shown (with respect to their positive and negative terminals) to avoid permanent damage to them.

When all the parts are in place, and their leads twisted around the studs, tighten the studs in the board.

8. Now, using the connecting wires provided, make all the remaining connections as



Drilling schedule



Parts placement diagram

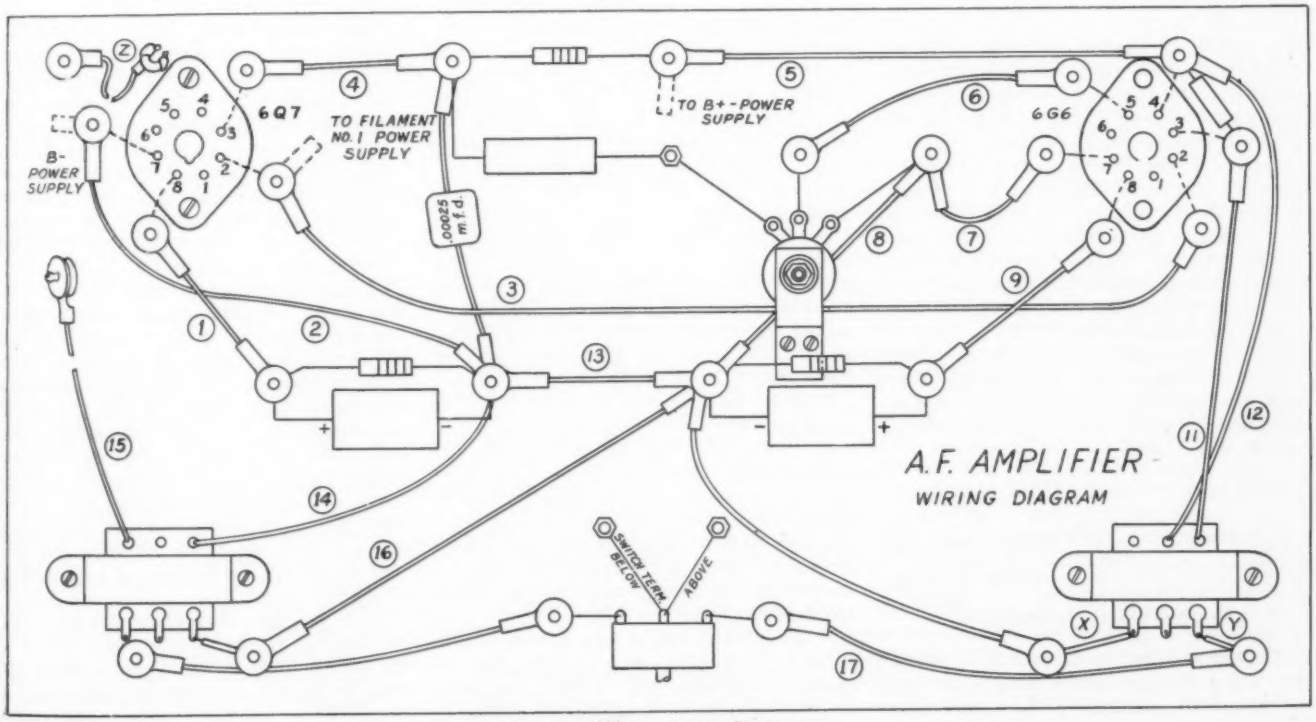
shown in the *wiring diagram*. This is done by pressing the snap fasteners down onto the ball end of the studs. In places where more than one wire connects to a stud, the snap fasteners should be stacked on top of each other, the socket in the upper one snapping over the ball top of the lower one. In every case, use the *shortest* wire available.

9. Fasten the loud-speaker brackets to the 5-in. squares of wood previously prepared, and attach the loud-speakers to their brackets.

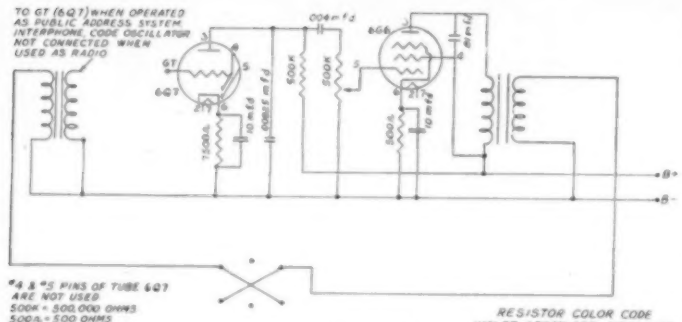
10. Place each tube in its proper socket. Note that the key on the center stem of the tube fits the keyway in the socket.

How to Test the Audio Amplifier

See caution about voltages under "How to Test the Power Supply," page 341 of the October, 1949, issue.

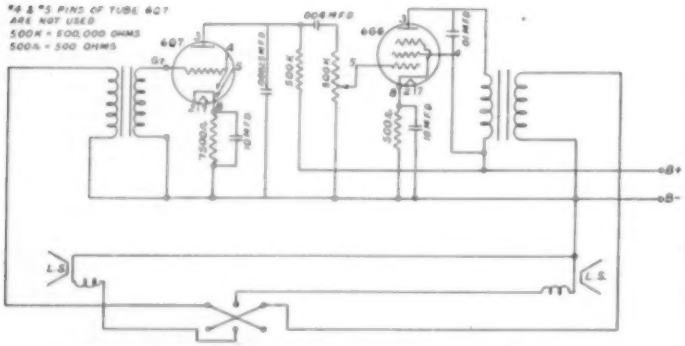


A.F. amplifier wiring diagram

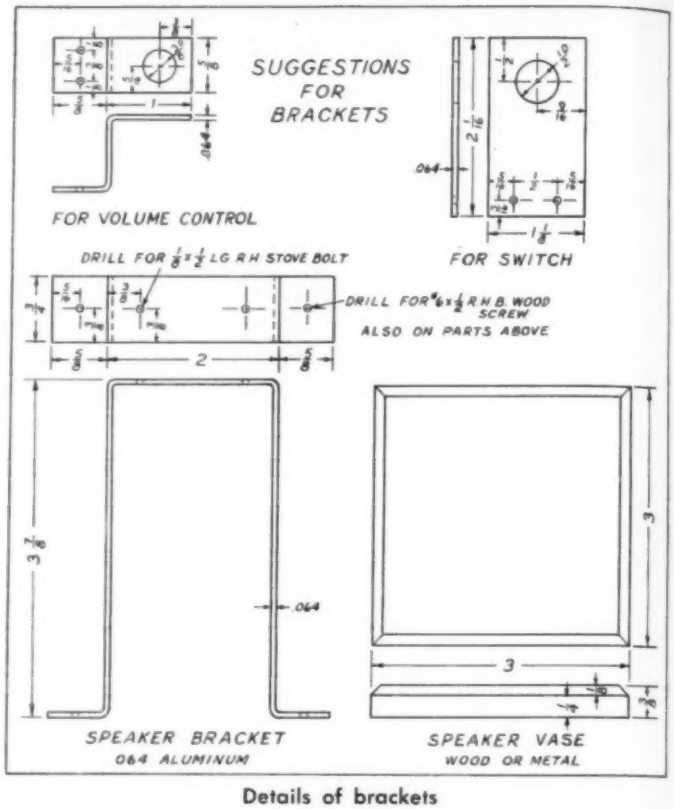


SCHEMATIC DIAGRAM FOR A.F. AMPLIFIER

Schematic diagram for a.f. amplifier



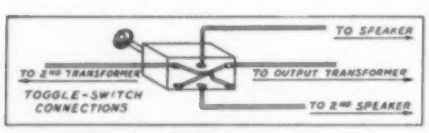
SCHEMATIC DIAGRAM FOR INTERPHONE CIRCUIT


SUGGESTIONS FOR BRACKETS
FOR VOLUME CONTROL
FOR SWITCH
DRILL FOR ⅛ x ½ LG R H STOVE BOLT
DRILL FOR #6 x ½ R H B WOOD SCREW
ALSO ON PARTS ABOVE
SPEAKER BRACKET
064 ALUMINUM
SPEAKER VASE
WOOD OR METAL

Details of brackets

NOTE: This amplifier is designed for use with the power supply, which is Unit No. 1 in the educational electronics course. If desired, however, it may be powered by any other electronic power supply which provides 6 volts for the heaters of the tubes, and 200 to 300 volts d.c. for B+, or by equivalent batteries. The following directions refer specifically to the educational electronics power supply, but may be readily applied to either of the alternates mentioned above.

1. Connect the two speakers to the audio amplifier. One of the leads from each speaker is grounded by connecting to the stack of snap fasteners on the right-hand end of connecting wire No. 13 (refer to the audio amplifier wiring diagram). The other lead from one of the speakers is connected to the left-hand stud leading to one of the center terminals of the toggle switch, and the second lead of the other speaker is connected to the right hand one of these two studs. These connections are clearly shown on the pictorial sketch of the unit.



Toggle-switch connections

2. Connect wire No. 15 (see A. F. amplifier wiring diagram) stud leading to the grid of the 6Q7 (labeled "Z" in the wiring diagram).

3. Using two of the long connecting wires, make the filament and B— connections indicated on the wiring diagram. The stud connected to pin 7 of the 6Q7 should be connected to Fil. No. 2 (see power supply diagram). The stud connected to pin 2 of the 6Q7 socket should be connected to Fil. No. 1.

4. After you have checked all your connections, turn the power supply on. If you have followed these directions correctly so far, the two tubes on the Audio Amplifier board should light up. You may have to shade the 6Q7 with your hand and look closely, because it doesn't glow very brightly.

5. After this step has been completed successfully, turn the power supply off. Now make the B+ connection indicated on the Audio Amplifier wiring diagram. Run a connecting wire from either end of connecting wire No. 5 to the lug marked B+ on the Power Supply wiring diagram.

6. Move the two speakers about 10 or 12 ft. apart, and turn the volume control to a position about halfway between its two extreme positions. Now turn on the power supply. If one of the two speakers begins to squeal, rotate it until it stops, or move the speakers further apart. Turning the volume control counterclockwise should also stop the noise. (This squealing is caused by "acoustical feedback.")

7. You should hear a hum in one of the speaker units. This one will then be the speaker — the other will be the microphone. If you turn the volume control clockwise, the hum will get louder.

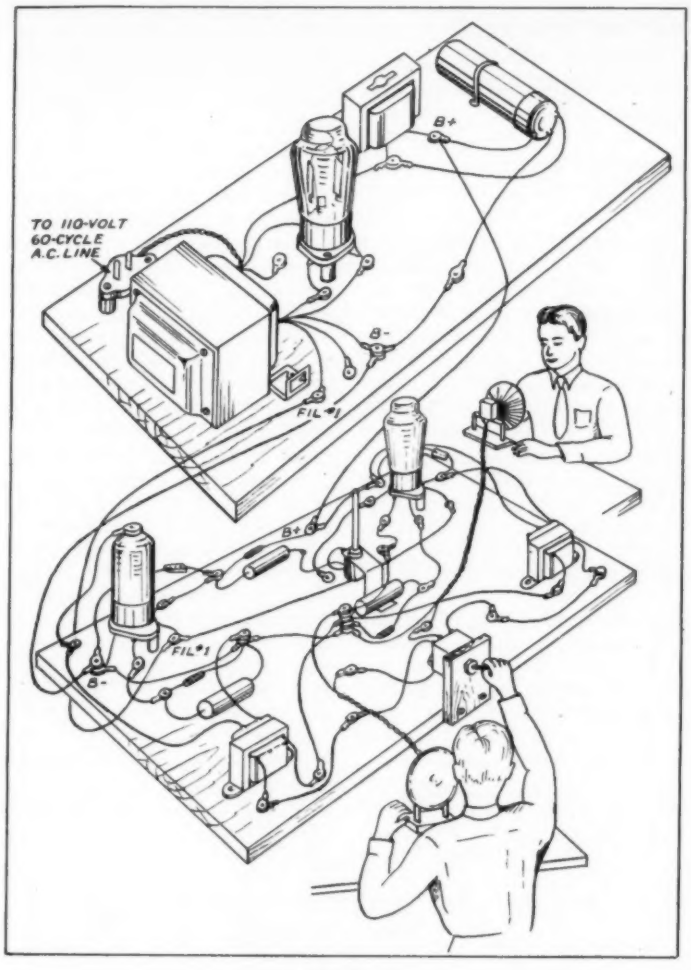
NOTE: If the unit fails to operate, as evidenced by lack of hum, or complete lack of feedback, turn off the power supply immediately, and read section 8 of these instructions.

Have a friend speak into the microphone, and you should hear his voice at the speaker. The volume control may be advanced clockwise to increase the loudness as long as the speaker and microphone are not located so as to cause feedback squeals. If you flip the toggle switch to the other position, then the speaker and microphone will change places, so that you may have a two-way conversation.

8. If the unit fails to operate, take the following steps in this order.

a) With the volume control turned clockwise about halfway, and the power supply turned on, touch either end of connecting wire No. 6 with your finger. If you hear a hum in the speaker then the 6G6 stage is probably working all right. Touch the grid cap of the 6Q7, and a hum or a squeal will indicate that both tubes are working properly, and the trouble is probably in the microphone or input transformer connections. If you hear a hum when you touch connecting wire No. 6, but nothing when you touch the 6Q7 grid cap, then the trouble is probably in the connections of the 6Q7 stage.

b) If the quick test of paragraph *a* gives no clue as to the trouble, then check all the wiring very carefully. Each connection must be exactly as shown in the wiring diagram, and as described in these instructions. If you find that any connection is incorrect



Intercom

or has been omitted, fix it and try the unit again.

c) If step *b* fails to reveal any fault, use the neon tester (described in detail in "How to Test the Power Supply," page 341, October, 1949, issue) to check the voltages. Connect one end of the tester to ground (either end of lead No. 13), touch the other end to lead No. 5, and turn on the power supply. One element of the tester should glow brightly. Leaving one side of the tester grounded, touch the other to lead No. 4. One plate of the tester should glow, but not nearly as brightly as when connected to lead No. 5. If it does glow as brightly or does not glow at all, then the 6Q7 tube is not functioning properly. The only other places in this unit which should cause the tester to glow when one side is grounded are leads No. 11 and No. 12, which will both cause the same brightness as No. 5. If this is not so in your unit, then the trouble must be in the 6G6 stage.

d) Connect one end of the tester to wire No. 12, and the other end to wire No. 11. Turn the volume control clockwise as far as it will go. Then speak or whistle loudly into each of the speakers in turn. If the tester glows when you make the noise, then the trouble is in the output or speaker connections. Leaving the tester in that position, and the volume control turned up full, put your finger on the grid cap of the 6Q7. If the tester glows, but you hear no sound from the speaker, then the trouble is probably in both your input, and output circuits, perhaps in the toggle switch.

NOTE: All of the foregoing tests are to help you find just which part of the circuit is not working properly. If any one of these tests does not give exactly the results specified, then that localizes the trouble. You should then make a very careful check against the wiring diagram and the schematic diagram, seeing that the connections are as shown, and that all the parts you have used are of the proper value.

e) The tubes may be at fault, and should be checked by your local service man.

f) A person familiar with the use of an ohmmeter may make a point-to-point check of the circuit, working from the schematic diagram.

The Audio-Frequency Amplifier

CAUTION: Although voltages such as are used in this amplifier are not dangerous, shocks are very unpleasant. Therefore, follow these rules: (1) always turn off the amplifier before making any circuit adjustments, and (2) always work with just one hand while it is turned on.

Experiment No. 1 — Tracing the Circuit

(Reference — Marcus and Horton, Chapters 17 and 20).

1. For this experiment you will need the schematic and parts placement diagrams, and a neon tester such as was used in testing the power supply.

2. By comparison with the parts placement and schematic diagrams locate the following parts. Examine each one for markings which indicate its size or other specifications. Make a five-column tabular list of these parts, indicating for each one the name of the part, its symbol, its location in the circuit, its value or size, and any other descriptive information you can get from the schematic or from the part itself. (Refer to Marcus and Horton, pages 676–677 for symbols, and pages 679–680 for the resistor color code.) The parts are:

1. Input transformer (lower left-hand corner of parts layout — same as output transformer)
2. Triode, 6Q7
3. Plate resistor for 6Q7
4. Cathode resistor for 6Q7
5. Cathode by-pass condenser for 6Q7
6. Coupling condenser
7. Volume control
8. Pentode, 6G6
9. Cathode resistor for 6G6
10. Cathode by-pass condenser for 6G6
11. Output transformer (low right-hand corner of parts layout)
12. Loud-speaker

3. Make sure that you are familiar with the operation of the neon tester, connect it to the 110 v. a.c. power line. Note its brightness, and whether one or both plates are lit. Then connect it from the 300 v. d.c. B+ to B— (called *ground*) on the power supply and make the same observations. How can you tell positive from negative? Use these two voltages as references.

4. Connect the amplifier to the power supply. Check its normal operation to make sure that all connections are right. After making this check the loud-speakers may be disconnected, if the noises from the following tests are distracting.

5. Use the neon tester to find out about the voltages in the triode state (the 6Q7) of the amplifier. Connect one lead from the tester to B—, which is the ground in this, as in most amplifiers. With the other lead, investigate the voltages on the heater, grid, cathode, and plate of the tube. If the tester does not glow, this indicates that the voltage is low. If the tester does glow, then compare the voltage with the two reference voltages you observed in step No. 3. Report these results in a table. Why is the plate voltage not the same as the voltage supplied by B+?

6. Investigate the voltages in the output (6G6) stage. Connect one lead of the tester

to the B— connection nearest this tube socket, and use the other lead to find out the size and nature of the voltages on the grid, cathode, plate, and screen of the 6G6. Be particularly careful in comparing the plate and screen voltage with B+. How do you explain what you observe? Make a table of the results.

Report

1. For each of the steps of the experiment, answer the questions, and make the necessary tables.
2. What two facts must always be known about a condenser?
3. What third fact must be known about an electrolytic condenser?
4. Explain how to tell the value of a resistor by use of the color code.
5. What is a potentiometer, and how does it work?
6. What are the purposes of the cathode and of the plate in a tube?
7. Remembering that electrons flow from minus to plus, tell how the current of electrons flows from B— through the 6Q7 to B+.
8. In view of your answer to No. 7, is the cathode positive or negative with respect to B—?
9. Does any direct current flow through the grid of a tube? What must be the grid voltage with respect to B—?
10. Is the plate of the 6Q7 as positive as B+? Explain.

(To be continued)

A TEACHING AID TO ILLUSTRATE HOUSE CONSTRUCTION

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The developmental teaching aid illustrating house construction is the result of a need to provide a visual aid that would assist the teacher in the presentation of construction features in a house. The device aids in making the discussion more realistic and at the same time give the student a better conception of construction units and procedures. This aid may be used also in the discussion of construction practices, identification of construction terms, building materials, consumer education discussions, architectural drawing classes, house planning lectures, occupational information lectures, and in many other teaching situations relative to the construction of a house.

The teaching aid consists of the four drawings, shown in Figure 1, each one a separate unit of a house, which, when placed together in their proper relationship, show a complete house as a single unit. See Figure 2.

One of the real values in this device is that only the unit being discussed need be shown. It thus tends toward a greater concentration of thought on that particular item, with no other units to offer a source of distraction. The basic organization of a lecture or demonstration on house construction would logically start with a presentation of the basement elevation as shown in Plate *A* of Figure 1. This plate also shows in a smaller proportion the plan of the basement. The lecturer may discuss this unit and describe its characteristics in view of the theme of his discussion.

The second unit consists of the first-floor joists and flooring which is shown on Plate *B*. With the help of this plate the instructor or lecturer may explain the characteristics of this unit as well as its relationship to the previously discussed basement unit.

The next logical unit in the evolution of the house in its construction would be the framing of the first floor walls as is presented in Plate *C*. The specific points of significance to this unit may be discussed and their relation to the previously discussed unit. As in the previous drawings, this plate may also be put on the stand in its correct position to stimulate the construction of this unit.

The fourth plate, *D*, consists of the roof and gable framing of the house. The various units of this part may be discussed and their characteristics noted. The plate may then be placed on the stand in its correct position with the other units, and this final drawing will complete the evolution of the house from the basement to the roof.

Construction of the Teaching Aid

The drawings *A*, *B*, *C*, and *D* are made on heavy display board and each drawing has two holes punched in it to facilitate its hanging on

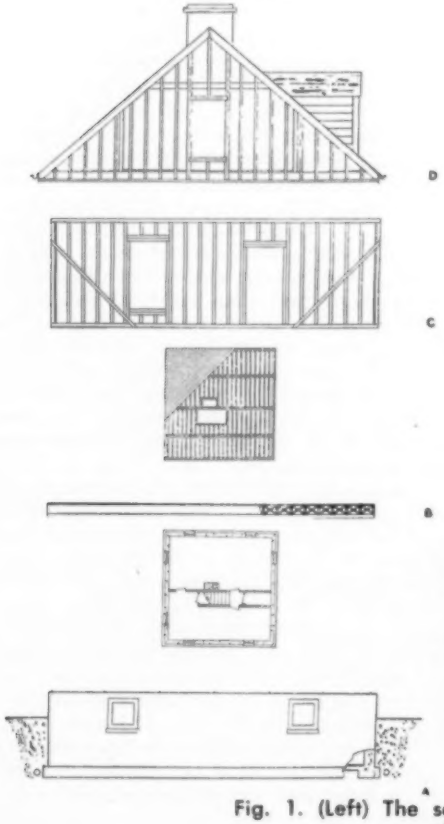

Fig. 1. (Left) The separate drawings of the house units. Fig. 2. (Right) The drawings of the house units assembled

a wooden frame or stand. The drawings should all be of the same size and the same scale should be used throughout. Great care should be taken in the placing of the holes in the drawings so that when each of the drawings is placed on the frame, a perfect registry of lines on all the drawings will result, and the units will all be shown in their correct position in order to illustrate the completed house. Small metal grommets may be placed in the holes to prevent the spread of the hole or tearing of the drawing.

The drawings may either be done by the students or by the lecturer. The drawings can be made more interesting by the use of coloring. This coloring appeals to the younger student as well as assisting the older student in the identification of units. The drawings should be made large enough so that every student in the room may be able to see them.

The stand may consist of a wood tripod arrangement with a wood crossarm fastened to it. The crossarm should have a pin or peg at each end of it on which the plates are hung. Such a tripod may be made at home, or in any school shop. There need not be any stand at all if there is space on the wall to place pins on which to hang the drawings. Special care should be taken to see that the distance between the pins is exactly the same as the distance between the holes on the drawings.

BALL-PEEN HAMMER

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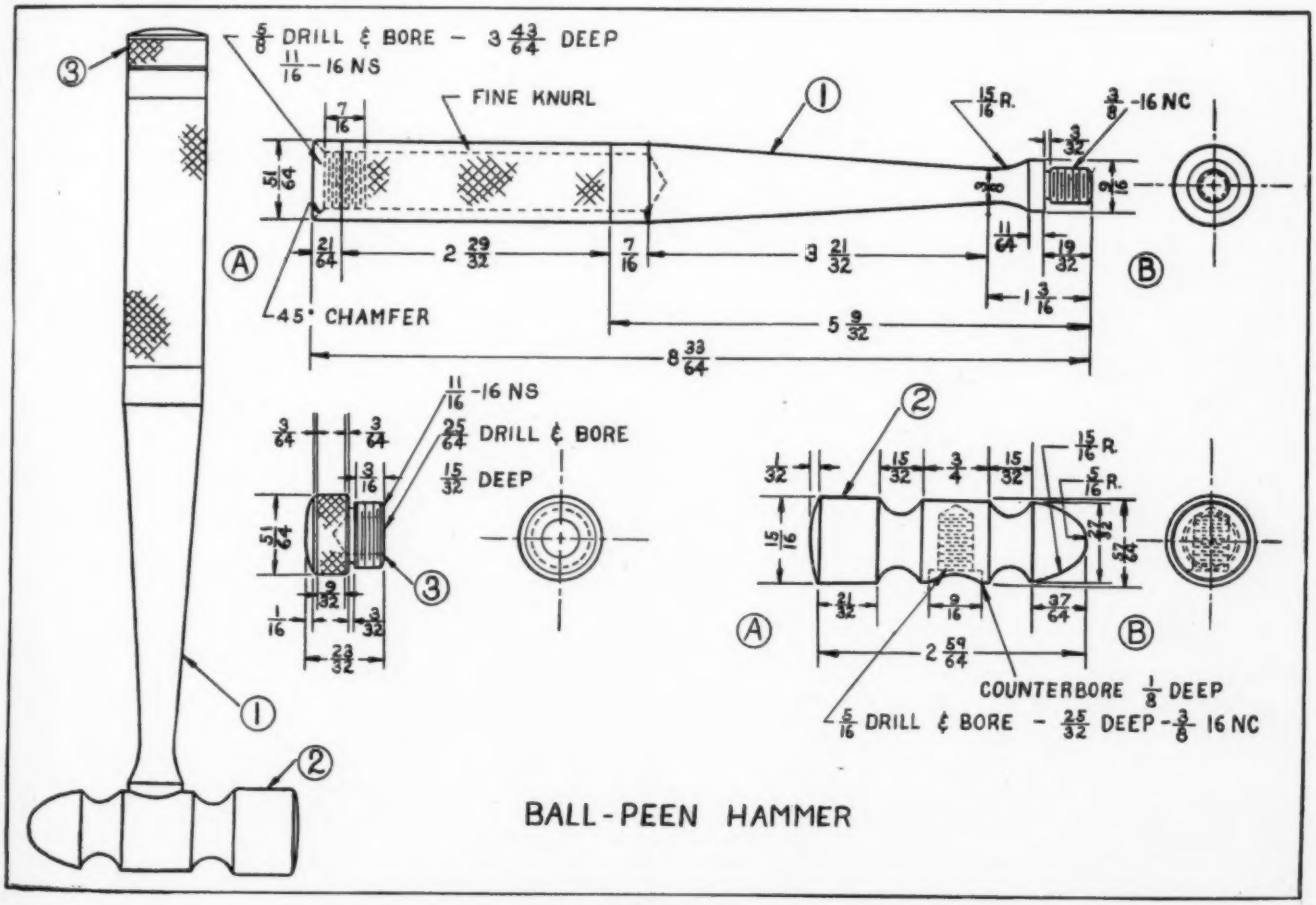
Tennessee Polytechnic Institute
Cookeville, Tenn.

Schedule of Operations

1. Lay out and drill center holes at each end of a piece of stock, long enough so that parts 1 and 3 can be turned at one time.
2. Turn to $5\frac{13}{64}$ in. ±.003 (entire length).
3. Scribe lines around stock with hermaphrodite calipers, locating dimensions along periphery of stock. Make all measurements from *B* end only.
4. Knurl parts shown in working drawing. Part 3 will be made on *A* end, and cut off when operational processes reach that stage of production.
5. Knurl part 3 on *A* end and $1\frac{1}{4}$ in. from that end.
6. Calculate taper per foot, or tailstock offset for turning taper shown.
7. Turn remaining portion of *B* end to $\frac{9}{16}$ in. ±.003 in.
8. Turn (freehand) $\frac{15}{16}$-in. radius at end of taper.
9. Prepare end *B* to receive threads as specified. Turn this portion also .005 in. under size to allow for clearance between mating threads.
10. Prepare end *A* to receive threads for part 3. Turn this portion also .005 in. under specified size.
11. Set machine for cutting required number of threads per inch and cut threads on ends *A* and *B*. Check completed threads with gauge.
12. Cut recess as per blueprint at ends *A* and *B*. Check with gauge again.
13. Mount independent chuck on headstock of lathe and insert *B* end of part No. 1 between jaws so as to leave about 1 in. of end *A* protruding from the face of the jaws. Place copper around stock to prevent jaw marks. Test truth of concentricity by using dial indicator.
14. Face part No. 3 to correct length and spot center.
15. Place drill chuck in tailstock and bore $\frac{25}{64}$-in. hole $\frac{15}{32}$ in. deep.
16. Chamfer end of threads.
17. Separate part No. 1 from part No. 3 by sawing with hack saw at a predetermined location. Be sure to leave enough excess length on both parts to allow for facing to exact length.
18. Face part No. 1 to exact length and spot center.
19. Place drill chuck in tailstock of lathe and bore pilot hole.


⅝ DRILL & BORE – 3 43/64 DEEP
11/16 – 16 NS
FINE KNURL
15/16 R.
⅜ – 16 NC
45° CHAMFER
11/16 – 16 NS
25/64 DRILL & BORE
15/32 DEEP
COUNTERBORE ⅛ DEEP
5/16 DRILL & BORE – 25/32 DEEP – ⅜ 16 NC
BALL-PEEN HAMMER

Details of ball-peen hammer

20. Bore 5/8-in. hole 3 43/64 in. deep. Taper shank drill will fit in tailstock.

21. Place center hole of tap on tailstock center and turn tap with a wrench. Tap as shown.

22. Chamfer as indicated.

23. Screw part No. 3 into part No. 1 and turn radius on end of part No. 3.

NOTE: All polishing should be done before part No. 1 and part No. 3 are cut into. This completes the handle.

Hammer Head, Part 2

1. Check stock from tool room; locate and drill center holes.

2. Face ends.

3. Turn end *A* to required diameter.

4. Turn end *B* to required diameter.

5. Turn middle section *C* to required diameter.

6. Scribe lines around stock representing edges of radii with hermaphrodite calipers. Bear in mind that center holes in each end of stock will be cut when turning operations are finished.

7. Turn freehand radius at left of center.

8. Turn freehand radius at right of center.

9. Polish work done thus far.

10. Scribe lines around stock representing the extreme ends of finished head.

11. Chuck up to run true with end *A* protruding from the face of the chuck jaws.

12. Cut off excess stock with hack saw, and form radius on end *A*. Polish this end.

13. Chuck up to run true with end *B* protruding from face of chuck jaws.

14. Cut off excess stock with hack saw and form freehand radius on end B. Polish this end.

15. Remove from chuck and locate center of tapped hole. Center punch lightly.

16. Place in independent chuck in a vertical position and make required tests for centering so as to make sure that center punched point is exactly in center of lathe. Recheck if you are in doubt.

17. Place drill chuck in tailstock and drill starter hole with a center drill.

18. Bore 5/16-in. hole.

19. Tap for 3/8-in. N.C. thread, using taps in proper order.

20. Counterbore as shown. Screw handle into head to check for fit.

CAUTION: Do not remove part No. 2 from chuck during operations 16, 17, 18, 19, and 20.

SIMPLE CORNER SHELF

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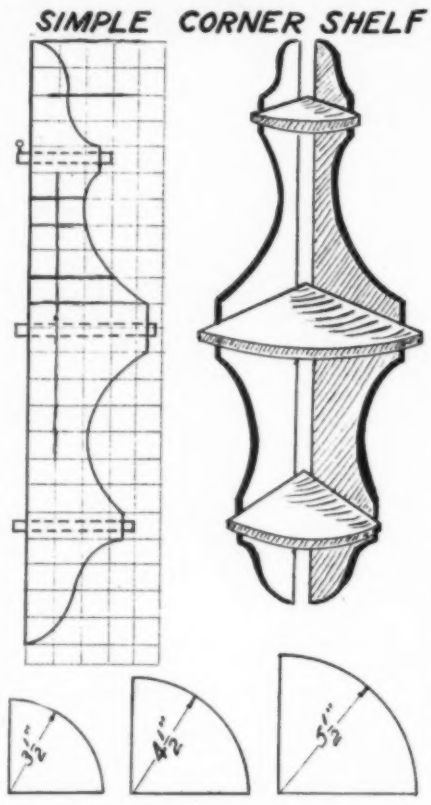
Johnson City, N. Y.

Here is a project well suited for the junior high school level. The cost of materials is practically nil; it is made from common orange crate lumber. The crate selected should be one whose ends and middle pieces are made of solid wood, and not plywood. Care must be taken in dismantling the crate as the sides split very easily.



BILL OF MATERIALS

No. of pieces	*Name*	*Material*	*Size*
2	Sides	Side of crate	4½ by 23 in.
1	Shelf	End of crate	3½ by 3½ in.
1	Shelf	End of crate	4½ by 4½ in.
1	Shelf	Middle of crate	5½ by 5½ in.

Procedure

Select the best two long pieces for the sides. Use a plane or cabinet scraper lightly on one side only. Lay out the pattern from squares or a template — whichever is preferred. The outline is then cut with a coping saw, or a jig saw, according to what tools the shop provides. Smooth the sides and curved outlines by sanding.

The shelves are made from the ends or middle piece. Both sides are planed lightly. When finished they are approximately 5/8 in. in thickness. Lay out the curve and saw along the line. Smooth surfaces and curves by sanding.

After careful sanding of the parts that will show, the assembly is easily done. Mark ½ in. in from the corner of each shelf along each edge. Line and square the sidepieces to the shelves. Nail and glue these together.

Finish according to taste. Stain and shellac, or paint and trim. The screw eye attached to the top shelf in the corner allows for easy hanging.

WHEN IS A PROJECT APPROPRIATE?

H. A. ALLENDER
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At the industrial-arts section meeting of a state educational convention, where project selection was being discussed this question was asked: "When is a project appropriate?" Various and sundry were the answers. The writer has found in teaching industrial-arts work for 25 years, that that question is a very significant one, and that its importance cannot be overemphasized. Failure to make a comprehensive study to this question may contribute materially to the breakdown of a whole industrial-arts program. While giving careful attention to the selection of projects will do much to contribute to the success of an industrial-arts program, the writer would most assuredly condemn the "Now boys what do you want to make?" approach.

The following criteria is used by the writer in the selection of appropriate projects.

1. The project must possess utility when completed.

2. The project must embrace teaching-learning situations.

3. The project must possess elements of good construction.

4. The project must possess elements of good design.

5. The construction of the project must be within the student's ability.

6. The project must embrace the use of materials that are available.

7. The project must embrace the use of available tools and equipment.

8. The project must fit into the school shop program relative to construction, finishing, and storage during the time it is in the shop.

9. The project must embrace a cost that is not prohibitive.

10. The project must be one that can be completed in the available time.

11. The project must be of a nature to require a substantial amount of the student's time and effort, and also create and maintain his interest until completion is accomplished. Assembling a ready-made project does not satisfy this last item while the making of small novelties often does not satisfy some of the other items. The making of any project in the industrial-arts shop should do *something* to the student. A continuous flow of well-made, well-finished projects from the school shop to the homes of the community will go a long way toward selling the instructor, the program, and the school.

A WOOD CARVING

F. CLARKE HUGHES
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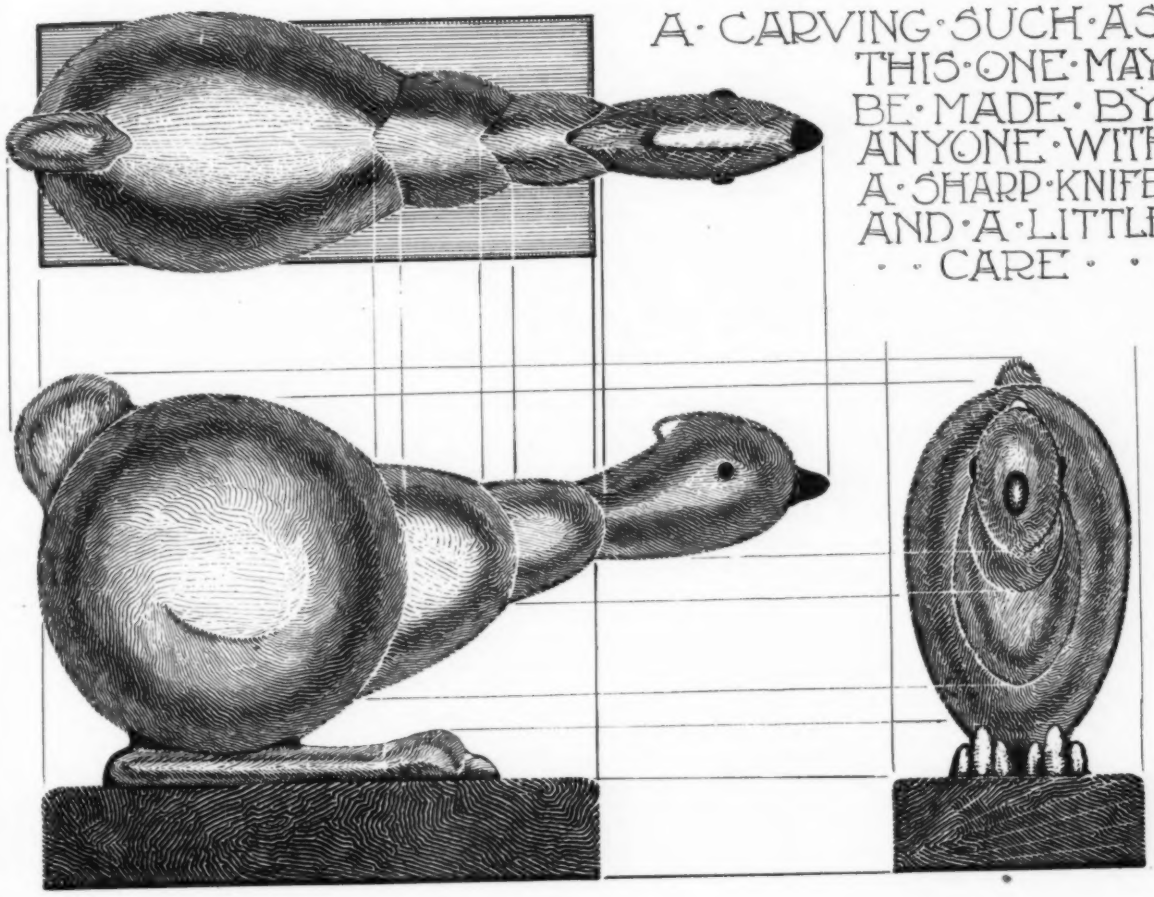
There is a real fascination in the making of a wood carving such as the one shown in the accompanying drawings. And the making of such a carving is not at all as difficult as

· A · WOOD · CARVING ·

A · CARVING · SUCH · AS THIS · ONE · MAY BE · MADE · BY ANYONE · WITH A · SHARP · KNIFE AND · A · LITTLE · · CARE · ·



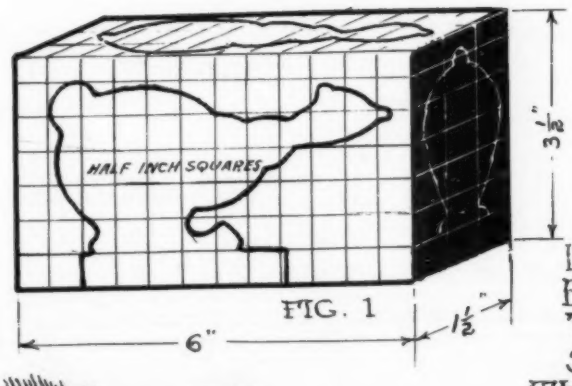


FIG. 1

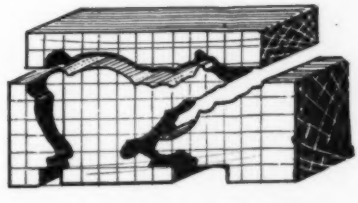


FIG. 2

IF · THE · ROUGH BLOCK · IS · CUT TO · GENERAL SHAPE · WITH THE · BAND · SAW OR · JIG · SAW · IT WILL · GREATLY AID · IN · CARVING

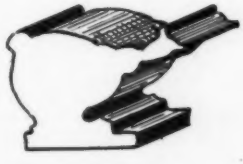


FIG. 3

FIG. 4

HUGHES

might be suspected by the readers who have not tried to do one.

Material: The first thing to do is to provide oneself with a 1½ by 3½ by 6-in. piece of clear gumwood or other similar wood. Gumwood is the wood suggested because of its beautiful grain and smooth texture that makes it ideal for carving. Black walnut is also a good wood to use although a little hard for the beginner to carve.

Roughing out: When the rough block is cut and squared up to size it should be spaced off into ½-in. squares as shown in Figure 1. The form can be drawn on all of the sides and the rough shaping done on the jig saw or band saw, as in Figures 2 and 3. In the absence of both of these power saws most of the surplus stock may be removed with an ordinary handsaw before starting to carve.

Tools: A good scout knife or other heavy jackknife is the best tool to do most of the carving with but in any case the blade must be sharp and keen edged. Good smooth strokes should be made and as the shape is gradually developed these cuts should be made smaller and smaller until when completed the surface should be slick and smooth with very little or no sandpapering needed.

Finishing: Any of the standard finishes for hard woods may be used on this project.

PUTTING MOTION INTO SHOP EXHIBITS WITH SIMPLE ELECTRONIC CAPACITY SWITCHES

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Northern High School
Detroit, Mich.

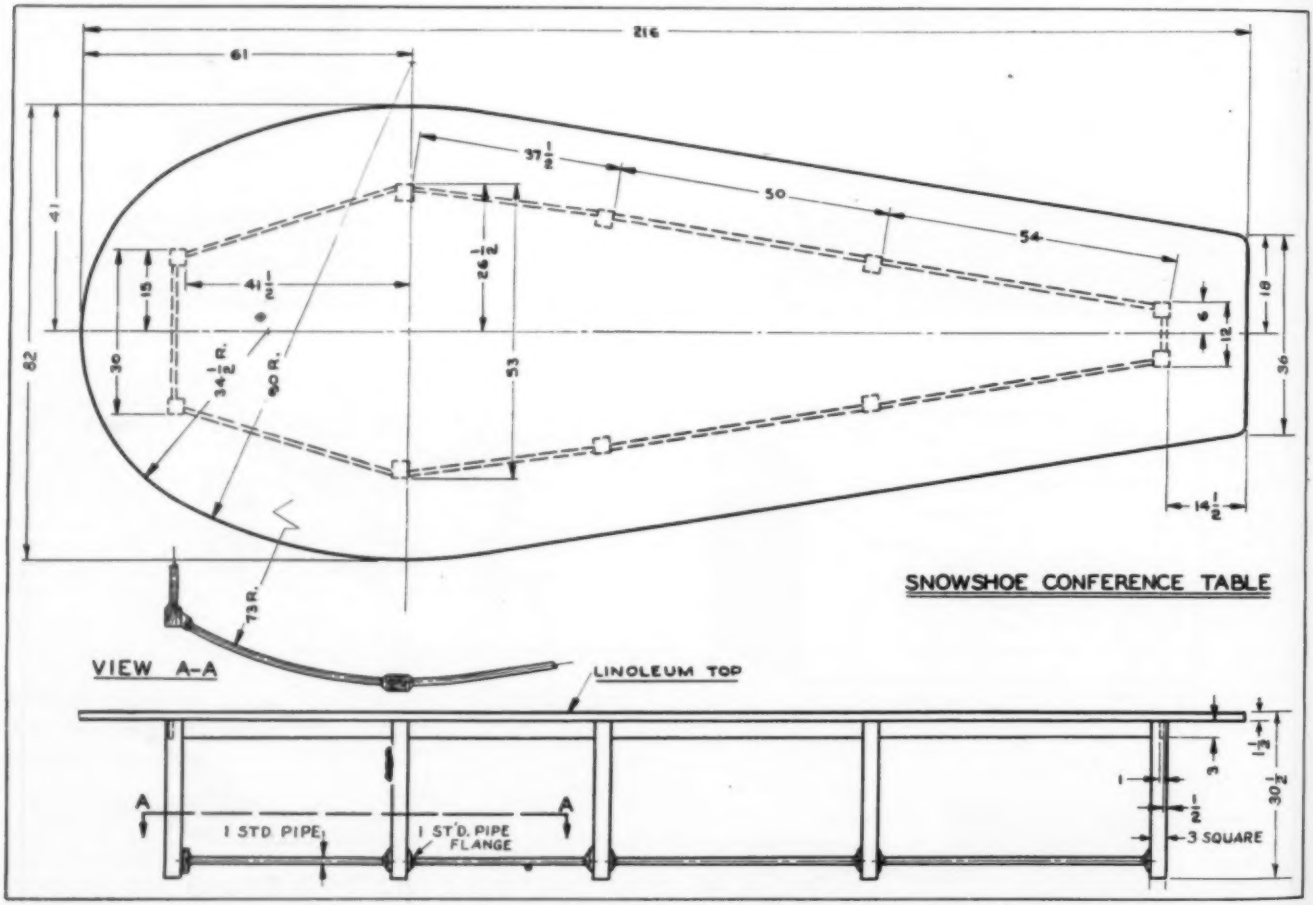
School shop exhibits are more effective when they contain moving objects. Motion is particularly effective in stopping people passing by if the people can start or stop the motion.

External control over motion inside the showcase can be easily introduced by the use of a capacity switch. With this simple device, an electrically operated mechanism can be turned on or off by bringing the palm of the hand near a metal plate fastened to the glass inside the showcase. Printed on the metal plate is a sign which reads "Place your hand here."

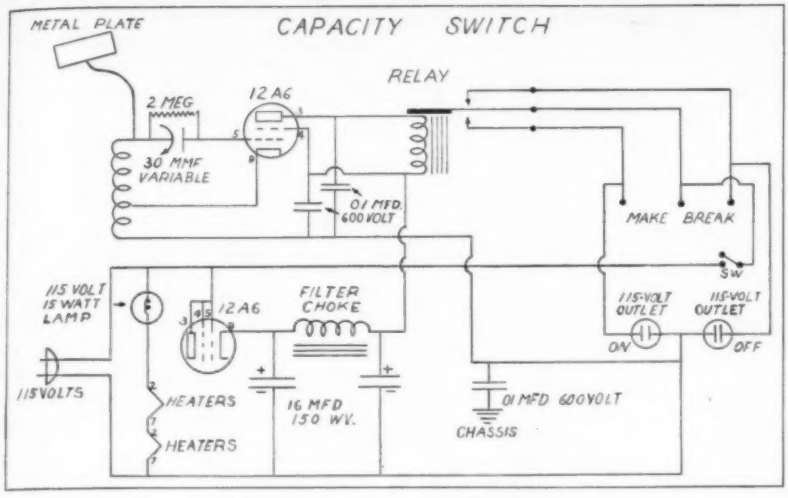
A toy electric train is excellent for the purpose of attracting attention. By means of a capacity switch an observer can start and stop the train or make it go into reverse. Other devices that adapt themselves to control by means of a capacity switch are, bright lights, big sparks, radios, slide projectors, or phonographs. One idea would be to use an automatic phonograph and a record on which explanations of the various parts of the exhibit were recorded. As the observer approached the exhibit, he would see a sign reading, "Place your hand here and wait for the voice." After the hand had been put in place, the automatic record player would start and a voice would be heard explaining the exhibit. A second capacity switch could be used to start and stop other electrical devices inside the showcase.

The capacity switch makes use of the well-known fact that when an oscillating radio tube stops oscillating, its anode current suddenly increases to several times its original amount. The capacity switch consists of a weakly oscillating radio tube with a wire running from its oscillator coil to the metal plate fastened to the glass inside the showcase. Bringing the observer's hand near the metal plate "loads" the oscillating circuit to such an extent that the oscillation of the radio tube is stopped. The increased anode current goes through the coil of a relay. The magnetism thus created attracts the armature of the relay and *makes* or *breaks* the circuit of the electrical device being controlled.

Any of the common radio-frequency oscillator circuits can be used in designing a



Conference table. Courtesy of L. J. Fletcher, director of training and community relations, Caterpillar Tractor Co., Peoria, Ill.



Capacity switch using 12A6 tubes

capacity switch. For convenience, the oscillator tube and its power supply should be mounted on the same chassis. To avoid interference with near-by radio receivers, the oscillator's frequency should be somewhat higher than the highest frequency in the broadcast band.

The following two circuits have been used with excellent results at Northern High School, Detroit, Mich.

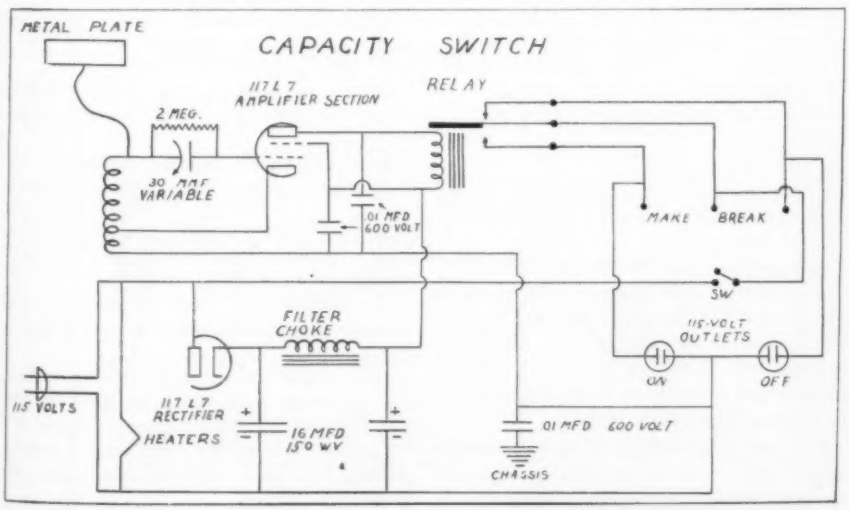
Each of these capacity switches was constructed on a small radio receiver chassis. The particular tubes and parts were chosen because they happened to be on hand in the *junk box*. Many other combinations of tubes and parts could have been used and circuits can be drawn using the tubes and parts that happen to be on hand. The oscillator coil used in both circuits was an electron coupled oscillator coil of the type commonly used in superheterodyne receivers using 6SA7 or 12SA7 converter tubes. The size of these coils is such that their frequency of oscillation (without using a tuning condenser) is greater than any of the broadcast band frequencies. The relay used with one capacity switch was taken from a small Army Signal Corps BC-357B receiver. The relay used on the other capacity switch was a Potter-Brumfield 5000 ohm relay type LM5 rated at 5 amperes with a minimum current rating for its coil of 1.7 milliamperes and a standard coil current of 4.5 milliamperes. Anyone building a capacity switch would do well to purchase the Potter-Brumfield 5000 ohm relay, since it was designed to be used in the anode circuits of radio tubes.

To avoid the hazard of electric shock, the B— (which goes to one side of the line in the "a.c.–d.c." type power supply) is not grounded to the chassis. The condenser (.01 mfd. or larger 600 volts d.c. working voltage) connected from the B— to the chassis helps to shield the oscillator coil and keep it from causing unwanted interference in near-by radio receivers.

In the circuit using the two 12A6 tubes, the 115 volt 15 watt lamp in series with the heaters of the tubes functions as a voltage dropping resistance to drop the line voltage from the normal 115 volts to the 24 volts needed for the two 12A6 tubes heaters connected in series. A 630 or 640 ohm 20 watt wire wound resister could be used in place of the 15 watt 115 volt lamp.

The 30 m.m.f. variable condenser is used as a sensitivity control in both circuits. This condenser must be insulated from the chassis. On the end of the variable condenser shaft is an insulated dial or knob used in adjusting the amount of oscillation and therefore the sensitivity of the capacity switch. In practice, this knob is adjusted to a point where the tube stops oscillating as soon as the hand comes near the metal plate and starts to oscillate again as soon as the hand is taken away from the plate. The exact adjustment will vary with the location of the switch and the length of wire between the oscillator coil and the metal plate.

This article suggests only a few uses of the capacity. Because a capacity switch can be used to turn any electrical device on and off, many other ways to use it will suggest themselves. As a means of attracting attention, a capacity switch used in connection with an electrically operated device is very effective.



Capacity switch using 117L7 tubes

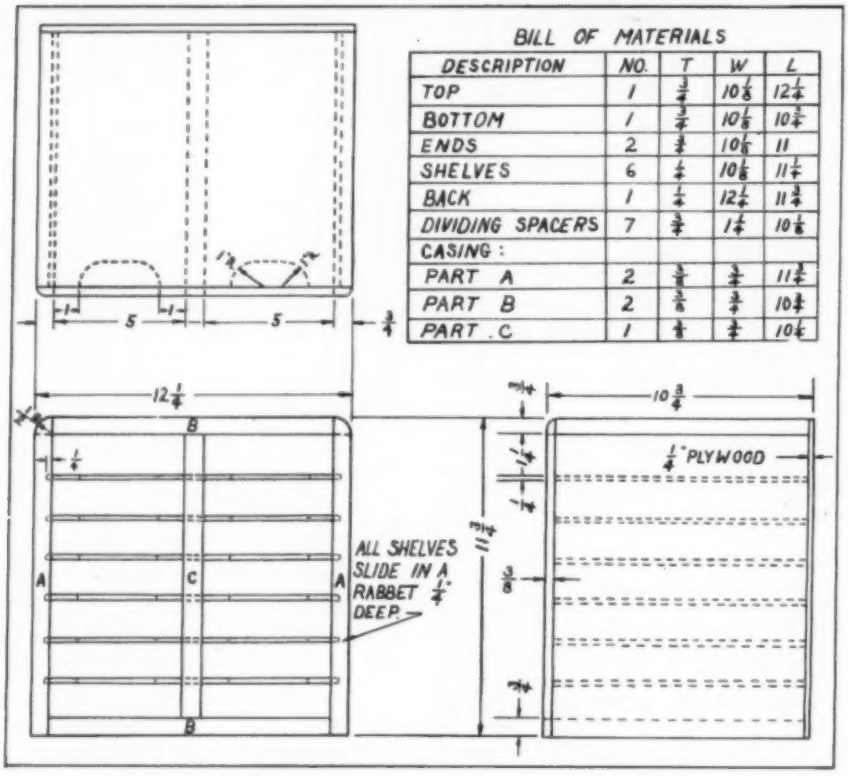
CHECKING THE DRAFTING INSTRUMENTS

R. PAUL LIGHTLE

Industrial Arts Instructor
James H. Smart Junior High School
Fort Wayne, Ind.

In our drafting classes the same set of instruments is used by several different boys. This means that a system of checking is necessary in order to prevent loss of equipment, keeping the set repaired and in condition to be used at all times.

Checking the drafting instruments


BILL OF MATERIALS
DESCRIPTION | NO. | T | W | L
TOP | 1 | 3/4 | 10 1/8 | 12 1/4
BOTTOM | 1 | 3/4 | 10 1/8 | 10 3/4
ENDS | 2 | 3/4 | 10 1/8 | 11
SHELVES | 6 | 1/4 | 10 1/8 | 11 1/4
BACK | 1 | 1/4 | 12 1/4 | 11 3/4
DIVIDING SPACERS | 7 | 3/4 | 1 1/4 | 10 1/8
CASING :
PART A | 2 | 3/4 | 3/4 | 11 3/4
PART B | 2 | 3/4 | 3/4 | 10 3/4
PART C | 1 | 1/4 | 1/4 | 10 1/4
1/4" PLYWOOD
ALL SHELVES SLIDE IN A RABBET 1/4" DEEP

Details of cabinet for drafting instruments

The cabinet described herewith was designed in order to meet this need, and it does just that. For each class a monitor is appointed to look after the drafting sets. When the student wants a set he sees the monitor, who first checks the set to see that the contents are as they should be. Then the monitor gives the set to the pupil, who also checks it before accepting the set. If there is any discussion it is referred to the instructor. At the close of the period the student returns the set, the monitor checks it, and then replaces it in the cabinet.

The system works with very little friction. At the same time it teaches responsibility and care of tools. In industrial arts the instructor has an opportunity and a duty in character development. One way we can meet this challenge is through the various systems of checking our equipment used in the shops. Through student participation, the system leads the pupil to accept responsibility.

ENGLISH FOR TRADE AND VOCATIONAL SCHOOLS

J. ALLEN MORRIS
Murray Vocational School
Charleston, S. C.

(See preceding articles in January, September, and November, 1948, and January, May, June, November, and December, 1949, issues)

Dictionary Drills

Vocational school students usually need much help with spelling before they are able to produce acceptably written work. Most of them can be taught to realize the necessity of using a dictionary as a handy aid to spelling if they are given enough work to develop the *dictionary habit*. In every class some dictionary work should be assigned, to be done either in school or at home as the instructor wishes.

A simple, easy-to-remember form for dictionary work should be suggested and used consistently. I use the following because it produces neat, readable papers:

Chisel: a metal tool with a cutting edge at the end of a blade, used in dressing, shaping, or otherwise working timber, stone, etc.

(Skip a line before writing sentences.)

1. Sentence.
2. Sentence.
3. Sentence.

(Skip a line before writing the next word and its meaning.)

Dictionary drills can be assigned individually, using mimeographed sheets, or it may be used collectively, by writing the material on the blackboard from which the students can copy it, or it may be mimeographed and distributed to all members of the class at the same time.

As I assign a drill to a boy, I usually suggest that he use in his sentences certain rules and principles which he is to try to learn and to remember. For example, a student who is learning complex sentences writes as many complex sentences as possible. If he is working on appositives, he puts several appositives in his sentences. If he is troubled by leaving off *s, 's, ed,* and *'s* on plural forms of nouns and past tense and past participial forms of regular verbs, he deliberately uses sentences containing plural forms of nouns and verb forms which end in *ed*. In this way he learns more and derives greater practical benefit from his dictionary work. These extra values, of course, cannot be secured if the work is done collectively as a class assignment.

The following drills are representative of dictionary work that can be offered. Based on words that are actually misspelled in my school, they help to improve spelling considerably. I have divided them into four groups, one for each year's work:

I. General:

Look up each of the following words in a dictionary. Write the word and its meaning on your paper; then use each word in three sentences: cost, much, week, enough, receive, February, sure, whose, fine, there.

I. Shop:

Directions: Write the meaning for each word; then use it in three sentences. Based on shopwork, your sentences must show that you understand the meaning of each word:

Auto Shop: automobile, axle, mechanic, brake, cotter pin, gear, bearing, wheel, battery, grease.

Drafting Room: angle, protractor, design, tracing, sketch, scale, draftsman, compass, pattern, measuring.

Electric Shop: electrician, electricity, motor, transformer, condenser, insulator, resistance, armature, conductor, generator.

Machine Shop: machine, machinist, bearing, lathe, calipers, solder, cutting tool, emery wheel, mandrel, wrench.

Woodshop: chisel, plane, square, pliers, pattern, filing, hammer, varnish, putty, coping saw.

II. General (Same directions as for I).

among, knew, through, believe, piece, too, until, buy, separate, whether.

II. Shop (Same directions as for I).

Auto: wrench, chassis, motor, gauge, engine, valve, steering, electricity, carburetor, transmission.

Drafting: spline, triangle, blueprint, slide rule, eraser, graph, rectangle, shading, diagram, title.

Electric: solder, pliers, farad, magnetism, permeability, retentivity, reluctance, laminated, commutator, dielectric.

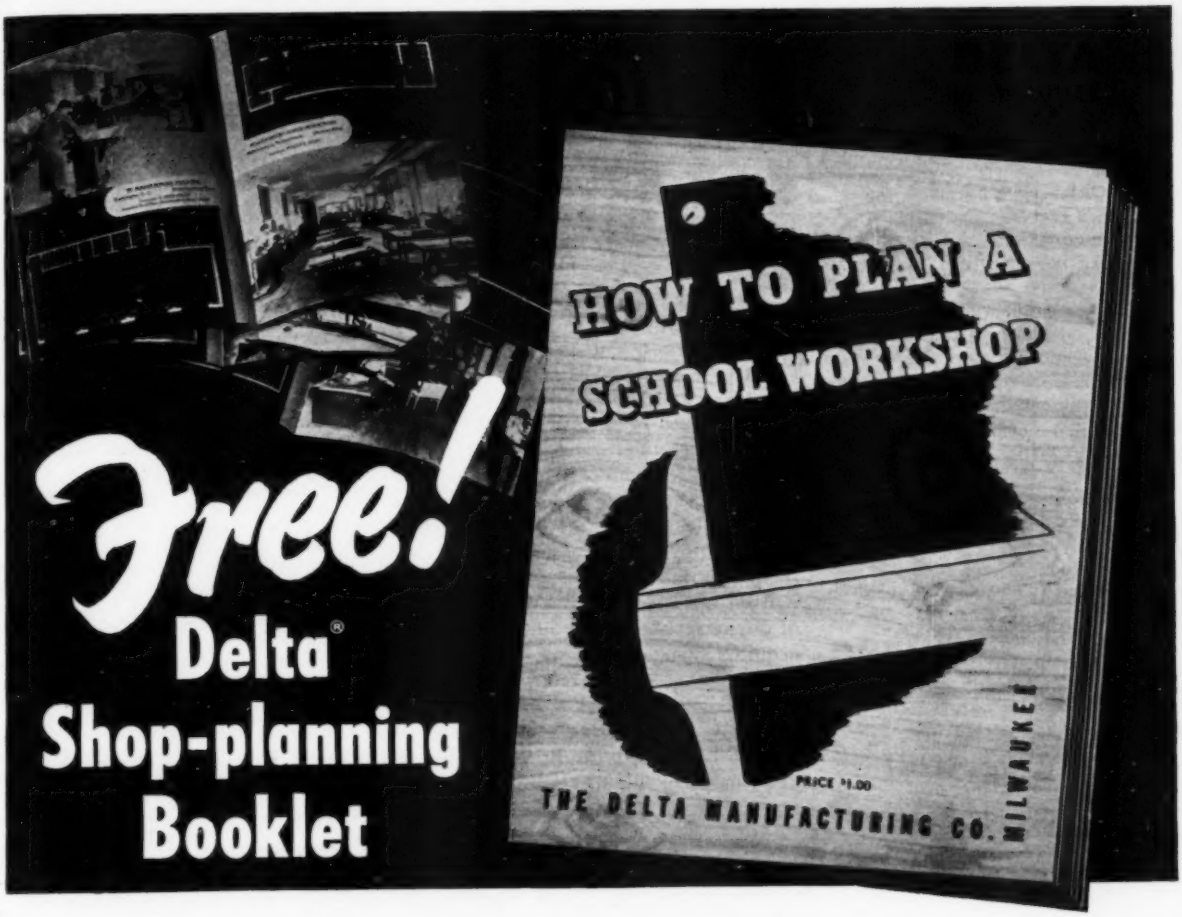
Machine: axle, micrometers, gauge, reamer, pulley, angle, pattern, temperature, machining, motor.

Wood: lathe, sketch, scale, drawer, cabinet, vise, C clamp, hack saw, sandpaper, groover.

III. General (Same directions as for I and II).

fuselage, microphone, miniature, interview, planing, television, convenience, manager, references, vocational.

(Continued on page 16A)



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— plus 5 Grinders . . . 3 Welders . . . 2 Shapers . . . 4 Radial-Arm Saws . . . 4 Abrasive Finishing Machines . . . 3 Cut-Off Machines . . . Lathe . . . Mortiser . . . Deburring Machine . . . 2 Saw-Jointer Combinations . . . 2 Planers . . . 2 Buffing Machines

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ENGLISH FOR TRADE AND VOCATIONAL SCHOOLS

(Continued from page 82)

III. Spelling, Dictionary, and Vocabulary Drills.

1. Use each of the following in one sentence: America, Charleston, Christmas, necessary, pleasant, strange, beautiful, special.

2. Use each of the following in two sentences: different, during, English, government, honestly, hospital, strength, thoroughly, usually.

3. Use each of the following in three sentences: machine, machinist, mechanic, electrician, received, swimming.

Write the meaning of each of the following words, and use each in three sentences:

1. advertisement, automatic, ambitious, sure
2. experience, graduated, immediately, certain
3. license, physical, position, principal
4. industrial, their, future, healthy

IV. General

A. *Directions:* Look up each of the following words and write its meaning; then use in three sentences:

1. among, angry, beside, may, most
2. human, immigrant, lay, leave, loan
3. continuous, contrast, mutual, reputation, two
4. apt, admire, vicious, loose, like

B. Use an unabridged dictionary for the following:

1. Look up each of the following words. Write each with or without a capital letter: baptist, india rubber, china egg, chicago.
2. Write the following words with or without hyphens: selfcontrol, nowadays, beforehand, biweekly.
3. Write the three principal parts of these verbs: lie, set, raise, come, know, lay, sit, rise.
4. Write the plural forms of these nouns: battery, mosquito, monkey, wolf, assembly.
5. Divide into syllables: abbreviation, university, introduction, Catholic.
6. Write the meanings of these abbreviations: f.o.b., B.C., A.D., C.O.D., pd.
7. Identify the following men: Bessemer, Goethals, R. E. Lee.
8. Write at least three synonyms for each of these: sweet, cute, nice, swell, pretty.

The foregoing drills are offered merely as suggestions. They are abbreviated considerably in several instances, to save space; but any instructor can quickly organize similar drills, using words that are misspelled by his own students.

After a student has completed a battery of dictionary drills like these, he will have acquired enough facility in using a dictionary to be able to use one satisfactorily in his senior class work — usually without being told to do so. After he leaves school, whenever he needs a dictionary, he will know how to use it successfully.

In addition to these drills, dictionary work is given frequently in connecton with literature, history, traffic safety, and ctizenship assignments. These correlated jobs range in difficulty from very simple to reasonably hard exercises, gradually working up from mere definition finding in the lower classes to interpreting long literary and technical terms and expressions with the aid of the unabridged dictionary.

Association News

THE A.V.A. CONVENTION

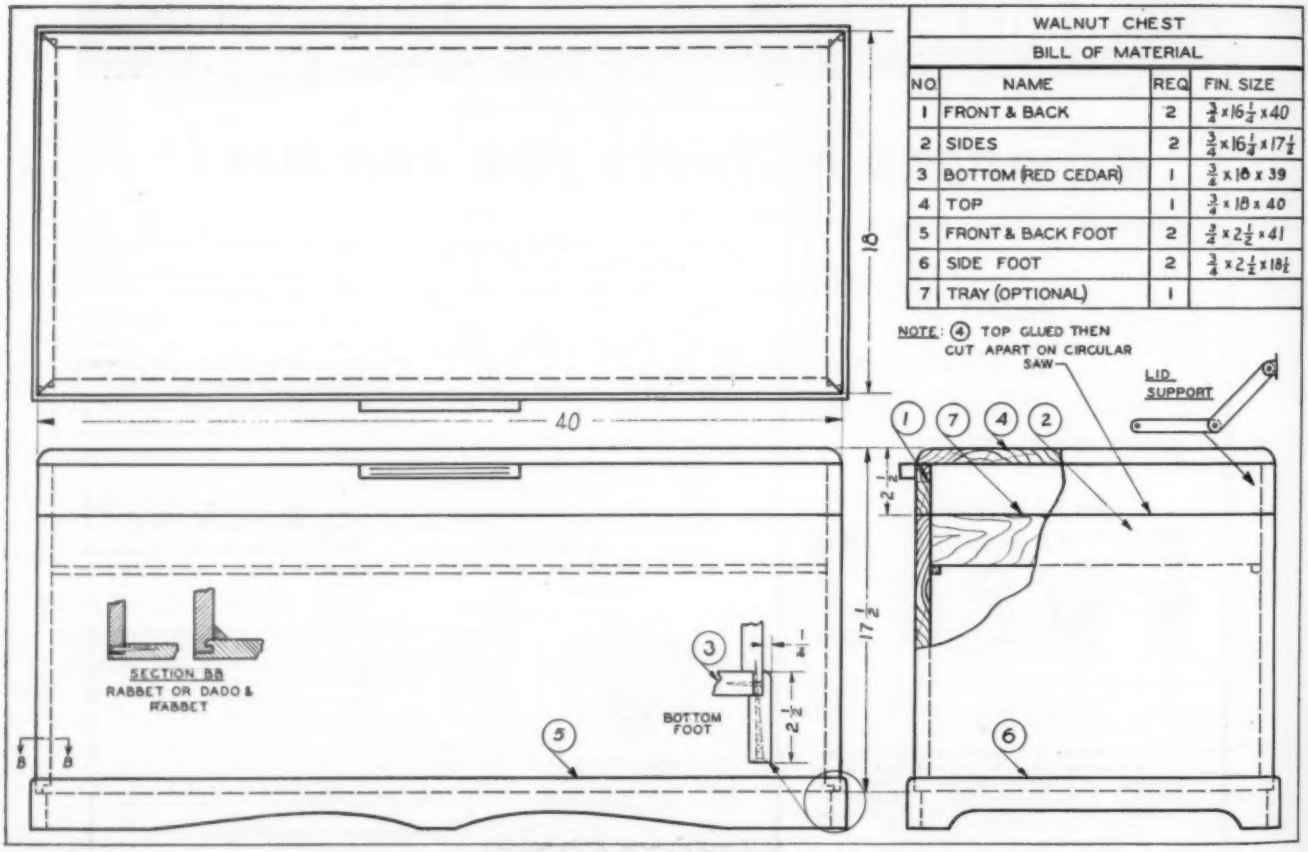
The Atlantic City Convention will go down in history as a very successful meeting. It was held December 6–10.

The attendance was very good. Twenty-eight hundred of the visitors were registered. The exhibits also were very good — about 75 firms having taken advantage of the opportunity offered by the annual A.V.A. gathering to meet and show their wares to teachers and administrators of industrial arts and vocational education.

The planning exhibit, consisting of drawings, blueprints, scale models, and a fine transparency box with six 5 by 7-in. shop pictures in color photography, was really outstanding.

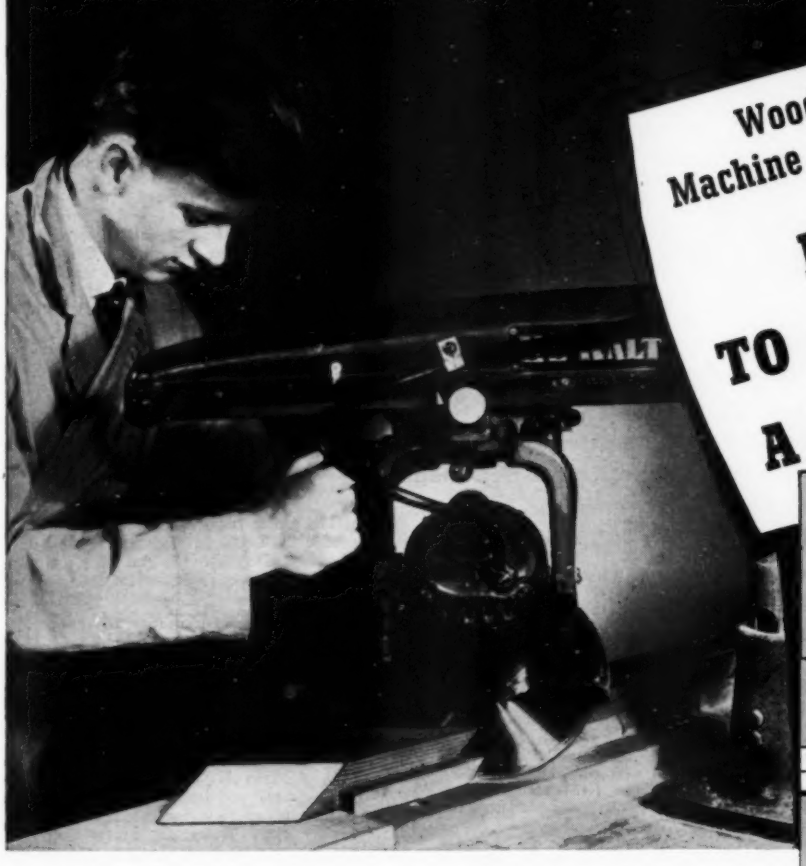
Practically all meetings were held in the convention hall in which the exhibits also were housed. A new departure in A.V.A. planning

(Continued on page 18A)


WALNUT CHEST
BILL OF MATERIAL
NO | NAME | REQ. | FIN. SIZE
1 | FRONT & BACK | 2 | 3/4 x 16 1/4 x 40
2 | SIDES | 2 | 3/4 x 16 1/4 x 17 1/2
3 | BOTTOM (RED CEDAR) | 1 | 3/4 x 18 x 39
4 | TOP | 1 | 3/4 x 18 x 40
5 | FRONT & BACK FOOT | 2 | 3/4 x 2 1/2 x 41
6 | SIDE FOOT | 2 | 3/4 x 2 1/2 x 18 1/2
7 | TRAY (OPTIONAL) | 1 |
NOTE: (4) TOP GLUED THEN CUT APART ON CIRCULAR SAW
LID SUPPORT
18
40
17 1/2
2 1/2
SECTION BB
RABBET OR DADO & RABBET
BOTTOM FOOT
2 1/2
1/4

Walnut chest submitted by Louis Barocci, High School, Cudahy, Wis.

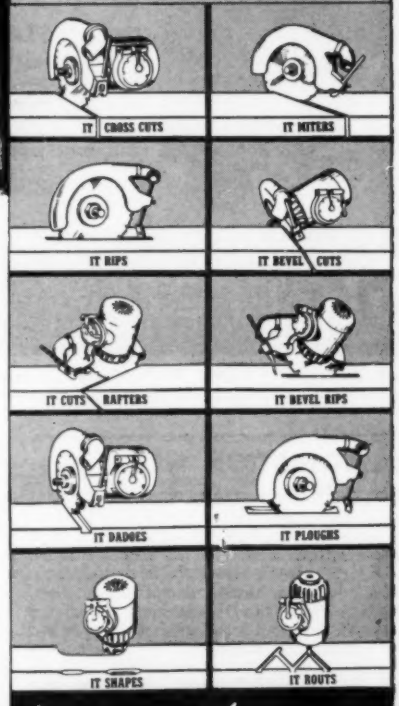
Make this a required course . . . and your wood-shop training is complete!



Wood Shop Machine Course No. 1

HOW TO OPERATE A DE WALT

DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

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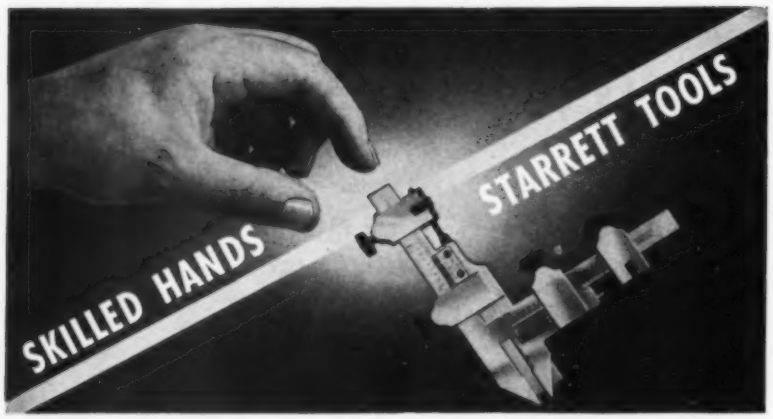

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ASSOCIATION NEWS

(Continued from page 16A)

consisted of setting aside one-half day for each of the A.V.A. groups (agricultural education, distributive education, home economics, industrial arts, industrial education, vocational education, rehabilitation, and vocational guidance), specifically for visiting the exhibits.

General Meetings

At the Tuesday evening meeting, presided over by President E. L. Williams, the main address was given by Fred W. Hosler, superintendent of schools, Oklahoma City, Okla.

Calling attention to America's high standard of living he stated that our program of public education had to be equally great and well planned. That too much dependence on high school curricula shaped around academic subjects has been the cause of a large number of the dropouts out of our secondary schools. Many of these dropouts later turn up as radicals, social and economic problems, and delinquents.

That we must seek to plan a broader program for all, and that we must remember that, since 87 per cent of our people still earn their living with their hands, vocational education, together with sound training in how to live in this modern world, should be specially emphasized.

Earl J. McGrath, U. S. Commissioner of Education, Washington, D. C., was unable to attend because of a European trip, but his speech was read by Rall I. Grigsby, Washington, D. C., Deputy Commissioner, U. S. Office of Education. President E. L. Williams presided again at the Wednesday evening meeting.

At this meeting Albert S. Goss, Master of the National Grange, Washington, D. C., urged that government aid will increase our taxes and costs, but that it will not solve the problems now confronting us. He urged that labor, industry, and agriculture must work together in maintaining a standard of full production.

That the hatred which has developed in labor, industry, and agriculture must be done away with and that complete co-operation must take its place.

At the annual banquet Andrew D. Holt, president, National Education Association, Washington, D. C., gave the address.

He said that federal aid tends to increase, rather than decrease, state and local efforts in support of education, and he believes that there is every assurance that Congress will provide federal aid for public education.

He pointed out that vocational education is a federal aid program which has been in successful operation for 30 years.

He cited Mississippi and Connecticut as examples of opposite extremes in per capita numbers of school children and finances for their education and of how federal aid for vocational education makes it possible for both states to maintain relatively high minimum salaries for qualified vocational teachers.

A high light of the banquet was the presentation of life memberships in the A.V.A. to more than 100 educators from all sections of the country.

Presentation of the certificates was made by L. H. Dennis, executive secretary of the association, Washington, D. C.

Agricultural Education

The agricultural A.V.A. section, which is represented by Louis M. Sasman, started its meetings Monday, December 5, and then continued with full programs until Saturday noon.

Industrial Arts Education

At the first meeting of this section on Tuesday afternoon John R. Ludington, specialist in industrial arts, U. S. Office of Education, Washington, D. C., was chairman of a discussion on "Basic Essentials of a State Program of Industrial Arts Education."

Roy G. Fales, state supervisor of industrial arts, Albany, N. Y., was the discussion leader of a panel consisting of Kenneth W. Brown, Philadelphia, Pa., James Hammond, Fitchburg, Mass., Ivan Hostetler, State College, Raleigh N. C., G. Wesley Ketcham, Hartford, Conn., and V. L. Pickens, Kansas City, Mo.

At the meeting on Wednesday morning, the subject for study and discussion was "A Good Program of Industrial Arts."

Shriver L. Coover, director of industrial-arts teacher education, State Teachers College, California, Pa., was the chairman.

Fred Schmidt, Muncie, Ind., spoke on "The Industrial Arts Teacher Studies His Pupils."

"Studying the Community" was presented by Philip Young, Pittsburgh, Pa.

R. Lee Hornbake, College Park, Md., discussed the industrial-arts curriculum.

Kenneth W. Brown was the discussion leader.

"Hobby Possibilities for Industrial Arts" was the subject set aside for the meeting on Wednesday afternoon.

Frank C. Moore, A.V.A. vice-president for industrial-arts education, and director of industrial-arts education, Cleveland Public Schools, Cleveland, Ohio, was chairman of the meeting.

Unfortunately, M. L. Byrn, professor of industrial education, University of Michigan, Ann Arbor, Mich., was absent at this session, but he made good on the subject of silversmithing at the Friday morning meeting.

Roy G. Fales gave a report of the activities of the Policies and Planning Committee.

The Thursday morning meeting was devoted to a serious study of supervision.

The speakers on this occasion were Claude Nihart, head supervisor, vocational and practical

arts, Los Angeles, Calif., and William R. Mason, supervisor of industrial arts, Cleveland, Ohio.

The Thursday afternoon session was omitted so that industrial-arts teachers, supervisors, and directors could visit the exhibits at the Convention Hall.

Friday morning, Chairman Lentz D. Gold, supervisor of industrial arts, Atlantic City, N. J., led a very interesting session at which Dr. S. L. Coover substituted for Walter E. Durbahn, Highland Park, Ill., in giving a short introductory talk, before giving a transcription of one of Walter Durbahn's "Walt's Workshop" programs, televised by WNBZ, Chicago, Ill.

M. L. Byrn showed a television teaching technique, and also gave a demonstration on how he teaches silversmithing.

The Saturday morning session was devoted to giving a number of industrial-arts demonstrations. Robert A. Campbell, supervisor of industrial education, Trenton, N. J., was chairman of the meeting.

M. E. Special, president, Plastics Development Corp., New York City, demonstrated a new method of casting plastics.

Robert L. Thompson, assistant professor of education, School of Education, New York University, New York City, showed how he used tricks of magic to arouse and keep the interest at a white heat.

David C. Knight, industrial-arts instructor, Wenonah, N. J., and Bard W. Stratton, chairman of industrial arts, Memorial High School, Haddonfield, N. J., showed several methods of working with plastics, and William J. Wilkinson, Nether Providence School District, Wallingford, Pa., described how to prepare strip films and slide films for instructional purposes.

(To be continued)

ANNUAL MEETING OF IOTA LAMBDA SIGMA

The Grand Chapter of Iota Lambda Sigma, professional fraternity in industrial education, holds its annual meeting in connection with the AVA sessions at Atlantic City on December 9. There were 99 members and guests present at the annual dinner and the honor guests included the majority of the leading figures in trade and industrial education.

National officers for the ensuing year were elected as follows: president — Glenn Smith, professor of industrial education, Oklahoma A. & M. College, Stillwater, Okla.; vice-president — George F. Henry, professor of industrial arts education, Colorado A. & M. College, Fort Collins, Colo.; historian — George H. Resides, Pennsylvania State College, State College, Pa. (re-elected); secretary-treasurer — Clyde H. Wilson, professor of industrial education, University of Tennessee, Knoxville, Tenn. (re-elected).

Officers of the National Advisory Council of the fraternity for 1950 are: chairman — Glen Brown, professor of industrial education, University of Maryland, Baltimore, Md.; vice-chairman — John Frank, industrial education, Hampton Institute, Hampton, Va.; secretary — Clyde H. Wilson, University of Tennessee, Knoxville, Tenn. (re-elected).

President Joseph R. Strobel, state director of vocational education, Ohio, presided at the annual meeting and made a brief report on the progress of the organization which now numbers 18 chapters and which during the past year added 384 members to its roster, including one new chapter at Northwestern State College, Natchitoches, La. Incoming officers were authorized to publish a directory of the fraternity membership which will include names and data on more than 3000 current members.

NORTHEASTERN OHIO INDUSTRIAL ARTS ASSOCIATION MEETING

Over 150 industrial-arts teachers of northeastern Ohio met at Kent State University, Saturday, December 3, in an initial meeting of the Northeastern Ohio Industrial Arts Association.

Under the direction of Dewey Barich, director of industrial arts at Kent University, an interesting program was presented on the general subject of "Wood Finishing."

Prof. E. W. Tishendorf of Kent University presented the speakers of the morning: W. W. Sharp and Tom Fancher of the Sherwin Williams Co.; R. H. Matteson of the Finishing Laboratories; and L. G. Slivka of the Pittsburgh Plate Glass Co.

The morning session adjourned to the Robin Hood Restaurant where Dr. S. L. Coover of State Teachers College, California, Pa., spoke on "The New Look of Drawing in the Industrial Arts Program."

The conference concluded by electing the following officers: president — Robert B. Boyer, Cuyahoga Heights School, Cleveland, Ohio; vice-president — J. H. Detrick, Parma High School, Parma, Ohio; secretary — Max Lerner, Ashland High School, Ashland, Ohio; treasurer — E. F. Myers, Ellet High School, Akron, Ohio.

The Northeastern Ohio Industrial Arts Association is composed of industrial-arts teachers from the 16 counties of northeastern Ohio in the area served by the Northeastern Ohio Teachers Association and includes such cities as Cleveland, Akron, Canton, Massillon, Wooster, Mansfield, Elyria, Ashland, Lorain, Ashtabula, Warren, and Youngstown.

♦ The Massachusetts Industrial Education Society will hold its fifty-third annual meeting on January 21, 1950, in the Hotel Sheraton, Boston, Mass., at six o'clock.

Dr. John R. Ludington, specialist in industrial arts, United States Department of Education, will be the speaker. His topic will be "Trends in

(Continued on next page)

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ASSOCIATION NEWS

(Continued from previous page)

Secondary School Industrial Arts Curriculum Making." There will be a social hour from five to six and a banquet at six o'clock. Reservations should be made to Joseph Rains, 4 Ashmont Park, Dorchester, Mass. — *Clifford Feindel.*

♦ The district meeting of Iowa Future Teachers Association was held October 17, 1949, at Simpson College, Indianola, Iowa. Ten students from the industrial-education department attended this convention. The main purpose in their attendance was to obtain further information concerning the I.F.T.A. Members of the Industrial Education Club are aiding the formation of a local chapter of I.F.T.A. on the campus of the Iowa State College, Ames, Iowa.

♦ The Michigan Industrial Education Society Region One Meeting was held Friday, October 28, 1949. The program for the meetings was a departure from that formerly used at this teachers' institute, and has aroused quite a bit of enthusiasm.

This type meeting was first held at Chadsey Trade School in Detroit last fall. The theme of the meeting in Dearborn this year was "Teaching Aids and Student Activities."

The meetings on Friday, October 28, started with a breakfast, and the program admonished members to come early, see your friends, and shoot the breeze.

From 9:00 to 10:00 opportunities were given to view the latest in teaching aids, look over the work done by students, see how other teachers do their teaching, and look over the new books and tools.

After that students demonstrated their skill in diagnosing what was wrong with sick autos.

At 1:00 p.m. a luncheon meeting was held.

James A. Lewis, superintendent of schools, Dearborn, was the toastmaster, and the Fordson High School music department furnished the music. After the business meeting Roland R. Fraser, president of the association, spoke on the "Michigan Industrial Education Association Goes Forward." Then Edwin Rowley spoke on the state convention in Grand Rapids. The trophy for auto starting was then presented after which Robert Wyatt, assistant principal, Jefferson Int. School, gave his address. William R. Stirton then superintended the drawing of the Ship's prizes.

Personal News

DR. SIRO APPOINTED TO CHICO STATE COLLEGE

Dr. Einar E. Siro has been appointed professor of industrial education and department head at Chico State College, Chico, Calif., effective February 1, 1950. Dr. Siro received the B.S. degree from The Stout Institute and the M.A. and Ph.D. degrees from the University of Minnesota under the advisorship of Dr. Homer J. Smith. His Ph.D. thesis was "The Preparation and Upgrading of Industrial Education Personnel." This thesis is an intensive report on the plans and activities of four types of collegiate institutions providing industrial arts and vocational industrial personnel for American public schools, with supporting controls and services of state departments of education. Origins, objectives, staffs, students, curriculums, practices, facilities, placements, relationships, and anticipated changes.

Dr. Siro's broad teaching and supervisory background in the industrial education field was accumulated in Minnesota public schools, The Armored School at Fort Knox, and the University of Minnesota. He has done summer work at Southwest Texas State Teachers College, Ohio University, Washington State College, and The Stout Institute. He has more than five years' trade experience and has been a frequent contributor to the periodical literature of the field.

ROY E. BURSINGER TO MANAGE OLIVER ST. LOUIS OFFICE

Roy E. Bursinger has been appointed manager of the St. Louis Office of the Oliver Machinery Co., 901 Commerce Bldg., St. Louis, Mo.

Roy E. Bursinger, manager of the St. Louis office of the Oliver Machinery Company

Mr. Bursinger came to the Oliver Machinery Company in 1929 as an expert demonstrator of woodworking machinery. He quickly added sales duties and has made many friends in his work in connection with school shops — layout of equipment both educational and industrial. He succeeds Geo. W. Crosley, who retired from this managership after having served the Oliver Machinery Company for more than forty years.

♦ WAYNE P. HUGHES, director, school and college division of the National Safety Council, visited the campus of Iowa State College, November 16 and 17, to talk to the students on the problem of school shop safety. On the evening of November 17 the Industrial Education Club sponsored a dinner in honor of Mr. Hughes.

♦ LEONARD LAU is teaching woodwork in the School for the Deaf and Blind at Romney, W. Va.

♦ A. P. TWOGOOD was visiting professor at the State College of Washington, Pullman, Wash., during the first summer session. He taught courses in visual aids and tests and measurements.

♦ JOHN KUBIAK, supervisor of occupational information and guidance, was guest speaker at the November meeting of Theta chapter of Epsilon Pi Tau, The Stout Institute, Menomonie, Wis.

♦ DR. R. LEE HORNBAKE has been granted a Fellowship at Harvard University, Cambridge, Mass. This fellowship program is a new venture in higher education.

Dr. Hornbake, professor of industrial education at the University of Maryland, has been given a leave of absence to pursue this post-doctoral study. He completed his graduate work at Ohio State University for his M.A. and Ph.D. degrees. He also taught at California State Teachers College, California, Pa., for two years.

♦ DAVID H. MORGAN was appointed dean of the college, succeeding Dean J. Lee Deen who has resigned the position now called "dean of the faculty," at Colorado A. & M. College, Fort Collins, Colo.

Dean Deen will continue his position as dean of the Division of Forestry and Range Management. Dean Morgan, who is dean of the Graduate School and director of the Summer Session, will continue those duties in his new position.

(Continued on page 22A)

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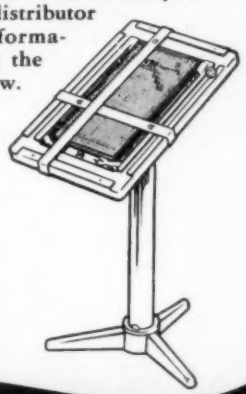

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PERSONAL NEWS

(Continued from page 20A)

STEPHEN V. BALLOU, associate professor of education, was named acting head of the Department of Psychology and Education, a position now held by Dean Morgan. The changes were effective January 1.

♦ H. M. HANSEN, who was the first full-time technical student at The Stout Institute, Menomonie, Wis., and who has seen it grow from the basement of a church to a full-sized college enrolling over 950 students, is now in his thirty-seventh year of teaching at Stout. He is associate professor of industrial education at the college.

Mr. Hansen joined the Stout faculty in 1912, and has worked under three presidents: Dr. L. D. Harvey, 1903–22; Burton E. Nelson, 1923–45; and the present head, Dr. Verne C. Fryklund. He has worked under three directors of industrial arts at the college — Buston, Rodgers, and C. A. Bowman.

After attending Stout for two- and four-year courses, Mr. Hansen obtained his master's degree from the University of Minnesota. He also has additional graduate credits from the University of Wisconsin, Colorado Agricultural College, and the University of Minnesota. In addition, Mr. Hansen studied at Forest Products Laboratories in Madison.

He is a member of Phi Delta Kappa, and Epsilon Pi Tau, both national honorary fraternities.

♦ MATHEW RENESON, instructor of mathematics and physics, has joined The Stout faculty, Menomonie, Wis. He obtained his B.S. degree at Fitchburg Teachers College, Fitchburg, Mass., and his master's at the University of Minnesota, in June, 1949.

One of his teaching jobs was at the Chicopee high school for two years, teaching mathematics, science, and drafting. At the same time he taught night classes in Springfield Trade School at Springfield, Mass. Chicopee is a suburb of Springfield.

Mr. Reneson spent three and a half years in the navy, much of which was spent in the Puget Sound North Ship Yard at Bremerton, Wash. His industrial experience, totaling about five years, was in tool designing, tool and die making, and drafting.

♦ RALPH W. FOX, 37, has been named assistant chairman of the applied mechanics department of Armour Research Foundation of Illinois Institute of Technology.

Mr. Fox received his B.S. degree from Drexel Institute of Technology, Philadelphia, in 1935.

♦ WILLIAM D. O'CONNOR has been appointed teacher of industrial arts, and coach, at Adel, Iowa.

♦ DURWIN M. HANSON has joined the industrial-education staff at Iowa State College.

He is originally from Decorah, Iowa, where he was graduated from high school.

Mr. Hanson obtained his B.S. degree from Iowa State College in 1939, and has since obtained his master's degree from that same institution.

Prior to the war he taught at Storm Lake, Iowa, and at Melvin Dale, Mich. During the war Mr. Hanson served as an instructor of aviation maintenance at Scott Field. Following the war he was with the Veterans' Administration in their training facilities department. He was with the V.A. for three years.

He is teaching drawing and woodworking in the industrial-education department at Iowa State College while he is working on his Ph.D. degree.

♦ WILLIAM WILSON is teaching industrial arts in the Jackson High School, Miami, Fla.

♦ CLYDE W. HALL of Winter Park, Fla., has received an appointment to the Arkansas A. & M. College, Pine Bluffs, Ark.

♦ EDWARD BOYD HAWKINS recently sponsored an industrial-arts open house program in his new general shop at Fredericktown, Pa.

♦ JAMES L. MCGINTY, formerly of Chester, Pa., is the new industrial-arts teacher at the high school at Brownsville, Pa.

News Notes

♦ The Iowa Future Teachers Association is sponsoring a chapter of the organization on the Iowa State campus. This chapter is being administered under the joint chairmanship of Day Morris and Tom Mossman, industrial education seniors.

The Industrial Education, Science, Vocational Agriculture, and Home Economics Education clubs are co-operating in the work of the chapter and are preparing the first campus meeting this fall of the I.F.T.A. at Iowa State College.

♦ A workshop in International Understanding will be sponsored by Colorado A. & M. College, Fort Collins, Colo., during the summer of 1950 starting July 22 to September 5.

The course is intended for college students of junior, senior, or graduate standing, and those who enroll will visit England, France, Switzerland, Germany, Austria, and Italy during that period.

The number of people who may enroll in the workshop is limited to 26, and 14 reservations have already been received for the course.

The class will sail from New York on July 22 via one of the major steamship lines directly for London. The group remains in London until

(Continued on page 23A)

NEWS NOTES

(Continued from page 22A)

the first of August, and then goes to Paris and later to the other countries scheduled. Ample time will be given for study in each of the countries which will be visited.

One of the outstanding features of the tour this year is the fact that each student is being provided tickets to the Oberammergau Passion Play, August 8 and 9.

For further information, write to Dr. David H. Morgan, dean, Colorado A. & M. College, Fort Collins, Colo.

♦ A bronze plaque, representing the Meritorious Award of the Association of Casualty and Surety Companies, given for maintaining high standards in driver instruction in more than 25 per cent of the high schools of the state and enrolling more than 25 per cent of its eligible students in such courses, was presented to Governor Patterson of West Virginia. More than one third of all eligible students were enrolled in such courses during the school year 1948–49.

Certificate reproductions of the plaque will be distributed to each West Virginia school which conducted a driver education course during that time.

♦ Industrial officials and educators at Carboloy Company, Inc., Detroit, Mich., have checked over the final details of a course of instruction designed to fit curricula of both colleges and secondary schools, covering design, selection, and use of carbide tools. Course includes all necessary teaching materials, including student work sheets, instructors' kits and work plans, visual and home-study material.

For further information write the Carboloy Co., Inc.

♦ "Modern Methods of Gear Manufacture," an 80-page, case-bound book, was published by National Broach and Machine Co., 5600 St. Jean, Detroit 13, Mich., at considerable cost. It was written for the guidance of industrial engineers and manufacturing executives responsible for the production of gearing of all types.

After distributing copies to key industrial executives throughout the country, there are a few left which the firm is offering to students and instructors in technical schools. Until the supply is exhausted, these will be forwarded free to those who apply.

♦ A colorful three-panel exhibit on care of the eyes, designed for use with pupils of grades four, five, and six, is now available on loan from the National Society for the Prevention of Blindness, 1790 Broadway, New York 19, N. Y. The borrower pays only the cost of return transportation.

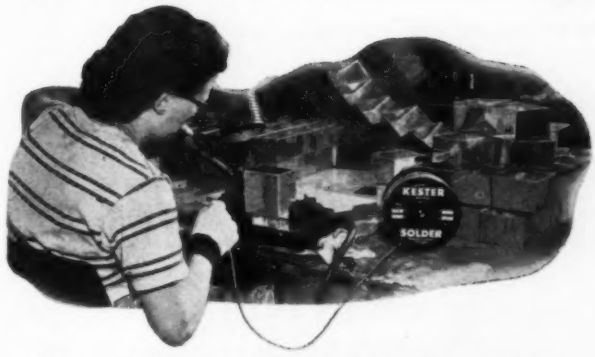
♦ Thousands of grade and high school students will learn principles of color and design, making decorative plates, plaques, canister sets, and many other articles for the home in Decal-craft projects.

Revised for 1950, the Decal-craft project kits may be obtained free by interested teachers writing The Meyercord Co., Educational Dept., 5323 W. Lake St., Chicago 44, Ill. Letters should provide the number of students in each class, the type and grade of the class, as well as the school name and address.

♦ The Department of State and the Board of Foreign Scholarships announce grants to 14 American citizens to teach in two educational institutions of the Philippines under the provisions of the Fulbright Act, Public Law 584, 79th Congress. These grants will include a basic living allowance, a supplementary maintenance allowance, and round-trip transportation, all payable in Philippine currency. Applicants should have a bachelor's degree and graduate work, be between the ages of approximately 25–50 years, have at least three years of successful teaching experience, and practical vocational experience. Appointments of successful candidates are for the single school year 1950–51.

(Continued on page 25A)

Kester Solder



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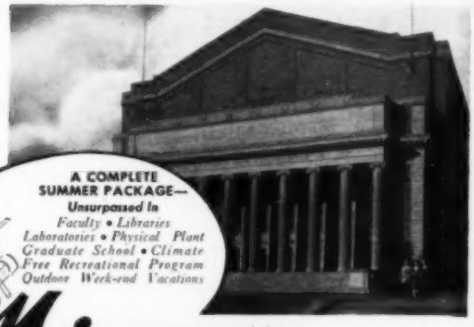

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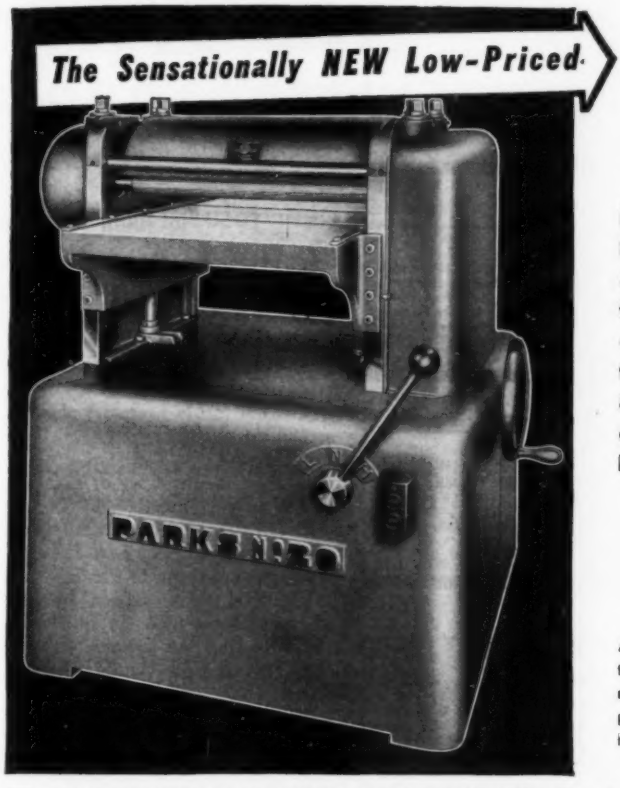

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NEWS NOTES

(Continued from page 23A)

It is planned that these schools will serve as model training schools for demonstrating how to train workers in agriculture and in the trades, train teachers to restaff the Philippine vocational schools, and serve as models for the development of similar vocational schools.

Experienced teachers for the following positions have been requested for the Philippine School of Arts and Crafts in Manila: automotive mechanics; plumbing; electrical wiring; sheet-metal work and air conditioning; machine operations; mechanical drawing, machine design, blueprint reading; woodworking with machinery; industrial arts; vocational education.

The National Agricultural School at Bukidnon on the Island of Mindanao has listed the following openings for teachers of agriculture: farm mechanics, animal husbandry, horticulture, farm management, agricultural education.

Persons interested in these opportunities may secure application blanks from and file their applications with the Division of International Educational Relations, Office of Education, Federal Security Agency, Washington 25, D. C.

♦ "The Pipe of Plenty," a prize winning color sound motion picture of the educational-information type, has been produced by The Jam Handy Organization, Detroit, for The Michigan Consolidated Gas Company. The film unfolds the story of the vast pipeline construction from Detroit to the Austin Field, Mich., fields. It shows how the 153-mile 24-in. pipeline was built over the toughest terrain in the dead of winter against the odds of blizzards, subzero temperatures, "impassable" bogs, frost and mud. It is a story of an industrial victory.

This movie is designed for free showings before interested schools and colleges.

For further information write Jam Handy Organization, 1775 Broadway, New York City.

♦ Educators Progress Service, Randolph, Wis., has published a brochure entitled "Presenting — The Educators Guide to Free Slide Films." It is available without cost.

♦ The Association of Casualty and Surety Companies, 60 John St., New Yory 7, N. Y., has developed a complete program for high school driver education, based on the revised textbook, "Man and the Motor Car," published by them. This text can be obtained in the regular edition, or in a special "State" edition.

The purchase of the book includes supplementary materials and standard tests in driver education.

For further information write to the accident prevention department of the association mentioned above.

♦ Governor Tuck of Virginia was presented a bronze plaque which represents the Meritorious Award of the Association of Casualty and Surety Companies. It was presented to him for maintaining high standards in driver instruction in more than 25 per cent of the high schools of the state and enrolling more than 25 per cent of its eligible students in such courses. This is the second successive year the award has been won by Virginia.

The ceremony was attended by officials of the Governor's Highway Safety Committee, the State Department of Education, the Division of Motor Vehicles and the Virginia Automotive Trade Association, and also by representatives of state and local insurance agents' associations.

Certificate reproductions of the plaque will be distributed to each Virginia school which conducted a driver education course in 1948–49.

♦ A fellowship leading to a master of science degree in chemical engineering at Illinois Institute of Technology will be given by the Chicago Paint, Varnish and Lacquer Association and the Chicago Paint and Varnish Production Club for the 1950–51 academic year.

The fellowship grants the winner $1,000 and $550 tuition for two semesters. The winner will be decided by a faculty committee, with the decision based on scholastic qualifications and extracurricular interests of applicants. A research project will be selected by the paint groups and the College.

Applications should be sent to the Dean of the Graduate School, Illinois Institute of Technology, Chicago 16, before March 15, 1950. Announcement of the winner or winners will be made to all applicants by April 1, 1950.

♦ President R. M. Hawkins of the Sul Ross State College, Alpine, Tex., announces that the industrial-arts department is to be allocated new quarters in the classroom section of the auditorium building. The space exceeds 8000 sq. ft. and will include areas for woodworking, machine shop, forging, welding, photography, farm shop, drafting, office, and storage space. A new building includes plans for ceramics. Prof. Victor J. Smith is head of the industrial-education department.

♦ Illinois Institute of Technology is now accepting applications for the 1950 Standard Oil Company (Indiana) fellowship in chemical engineering.

The award of $1,700 will be made to the successful applicant. The only stipulation made in the grant is that the research deal with some phase of chemical engineering of general interest to the petroleum industry.

Term of the fellowship will begin September, 1950. Applications must be received by March 15, 1950. The winner will be announced April 1. Further information and application blanks may be obtained from the Dean of the Graduate School, Illinois Institute of Technology, Chicago 16.

♦ High school printing teacher Adrian P. Pollock of Ferndale, Mich., has satisfied a desire to earn his master's degree in education by pro-

(Continued on next page)

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(Continued from page 387 of the November, 1949, issue)

Assignment Sheet No. 56 — Timing a Two-Point Ignition System

Why this is done:

With the increase in the number of cylinders and also the increase in engine speed, many motors use two sets of breaker points with half as many ignition cam lobes as there are cylinders in the motor. This arrangement cuts in half the operating speed of each set of points, but makes necessary the timing of the second set.

Procedure:

1. Time the first set of points as directed in Assignment Sheet No. 55.
2. Turn the motor over the short distance necessary to bring the next piston in the firing order up just ready to fire.
3. Adjust the second set of points by means of the movable plate on which they are carried until they are just ready to open.
4. Tighten plate clamp screws and recheck adjustment.

NOTE: Do not confuse the movable plate clamp and adjusting screws with the screws for adjusting point clearance.

Questions:

1. Why have two sets of ignition points? Give two advantages.
2. Name two disadvantages of two sets of points.
3. Could a 16-cylinder engine operate on one set of points?

Text reference: ....

Assignment Sheet No. 57 — Wiring an Ignition Circuit

Why this is done:

To induce a high voltage in the secondary circuit and to carry that voltage to the spark plugs, it is necessary to connect the correct contacts with the right kind of wire.

Procedure:

1. Review the diagram of the particular motor, and the relation of the different units of the ignition circuit. See Assignment Sheet No. 52.
2. Connect the primary coil terminals one to the distributor point contact post, and one to the positive battery terminal, or the starter switch post.
3. Connect insulated condensor terminal to distributor point contact post.

NOTE: Condensor may be built in.

4. If ammeter and ignition switch are used, they must be connected in series between coil contact post and distributor point contact post.
5. Connect the secondary of the coil to the center of the distributor cap, and the outer cap contacts to the various spark plugs. The first connection should be made from the outer contact nearest the rotor to that plug whose piston is then in position ready for a spark.

(Continued on page 34A)

NEWS NOTES

(Continued from page 25A)

ducing a series of 25 color slides on "Locking Up Type Forms for the Platen Press." The production of this series of slides was prompted by the fact that there are not any known visual aids of this nature on the market in the graphic arts area. This project, along with a 23-page essay, earned Mr. Pollock's degree for him from the College of Education of Wayne University, Detroit, Mich.

The 25 slides consist of one title slide, and a breakdown of the actual steps in locking up a form — each being presented in its simplest form. In the preparation of the slides, Mr. Pollock made black and white prints for experimental purposes; then, with all corrections in, used a Kodak Bantam with F/4.5 lens to produce the 24 colorful, interesting instructional slides. The original set of Kodachrome slides was presented to Dr. G. Harold Silvius at Wayne University in June, 1948, as partial fulfillment of the master of education degree.

Mr. Pollock is now preparing script and photograph shots for a series on Press Make-Ready.

For additional information, as well as complete full-color sets of the present film on lockup, write Mr. Adrian Pollock, 273 E. Troy, Ferndale, Mich.

More than 10,000,000 World War II veterans have applied for education and training under the GI Bill since that law went into effect in June, 1944.

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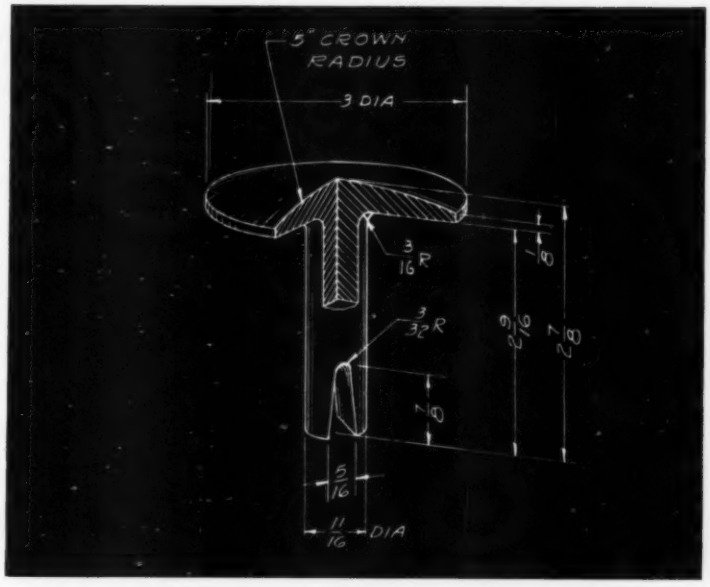

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ELECTRICAL MACHINES — DC AND AC CURRENT — *Siskind*

BASIC ELECTRICAL PRINCIPLES — *Suffern*

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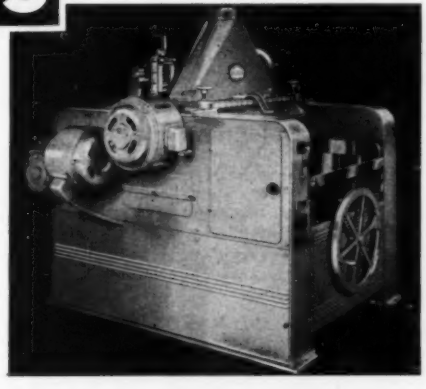

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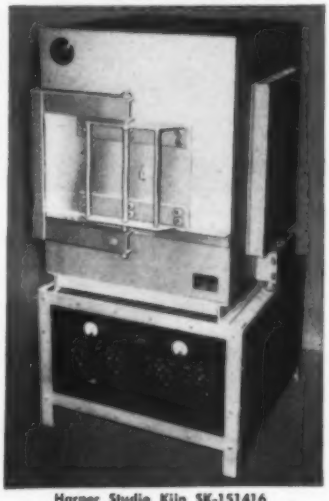

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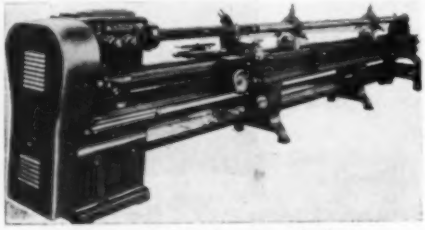
Shop Equipment News
NEW PRODUCTS — PUBLICATIONS

SEBASTIAN 20-IN. LATHES WITH LONG BEDS

Sebastian 20-in. geared head lathes, manufactured by the King Machine Tool Division of American Steel Foundries, Cincinnati 29, Ohio, are now being produced in extra long bed lengths. These 20-in. lathes, both general-purpose and gap types, are available in bed lengths up to 20 ft. They are designed to handle a full range of work, including long, lightweight pieces ordinarily machined on expensive, heavy-duty lathes.



Long bed Sebastian lathe

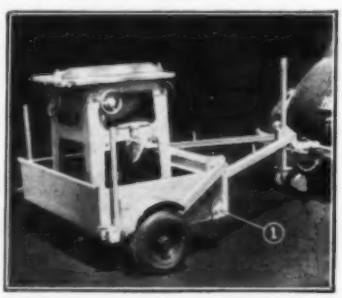
Sebastian lathes are manufactured in 12-, 16-, and 20-in. sizes, in general purpose, clutch and brake, and line shaft drive types. Gap and metric screw types are also made in 16- and 20-in. sizes.

They are equipped with 8-speed geared heads, having Timken tapered bearings on all headstock shafts and Timken precision bearings on spindle. Other principal construction features include reverse in apron for feeds; knob control handle for apron-length feed friction; 54 feed and thread changes; accuracy .0005 in. at every point of alignment. A large number of items are furnished as standard equipment, included in the basic price of the lathe.

For brief reference use IAVE—0201.

WOODWORKING MACHINERY TRAILER

A new line of trailers for the transport of woodworking machinery "to the job," has been announced by J. D. Wallace & Co., 140 S. California Ave., Chicago 12, Ill. These trailers also are offered in special models to suit the requirements of other manufacturers.



Woodworking trailer

These new units include a grasshopper model (bare chassis for transporting the Wallace No. 1 radial saw); and the Cargo Chariot — the general-utility model shown in the illustration.

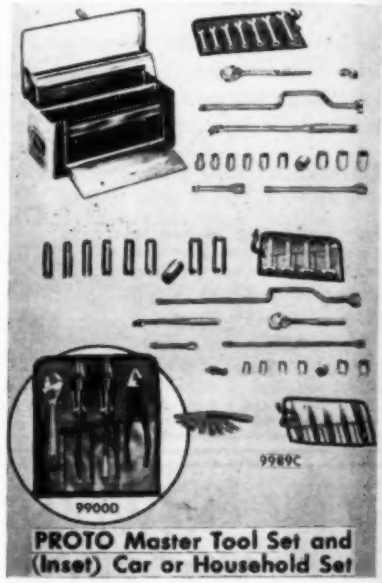
All have an airplane-type spring suspension or smoother, easier riding at highway speeds. Leveling jacks in three positions permit the trailer to be disconnected from the car and adjusted for best working height.

For further information write the firm mentioned in the foregoing.

For brief reference use IAVE—0202.

PROTO MASTER TOOL SET CONTAINS 68 ITEMS

The addition of a 68-piece Proto master tool set and a 5-piece car or household set has been announced by the Plomb Tool Co., Los Angeles, Calif. The master set, No. 9989C, is intended for industrial maintenance, providing needed tools for trouble shooting and reducing time in breakdowns. It is also recommended as a basic set for the repair of cars, trucks, tractors, refrigerators, etc. The set includes 9 feeler gauges and a holder; 4 punches and a chisel in a flexible kit; 7 combination box and open-end wrenches, with ⅜ to ¾-in. openings, in a kit; 4 tappet wrenches in a kit; 7 socket wrenches and 6 handles and attachments for ⅜-in. drive; 19 socket wrenches and 6 handles and attachments for ½-in. drive, and a 20½ by 11½ by 9-in. tool chest with three trays.



Proto master tool set, and (inset) car or household set

The new Proto car or household set, No. 9900D, fits easily in the glove compartment of a car or in a kitchen drawer. It includes four high-utility tools — a slip joint plier, an adjustable wrench, a plastic handle 9/32-in. bit screw driver, and a plastic handle Phillips No. 2 screw driver. All of this is marketed in a flexible kit.

For brief reference use IAVE—0203.

SEVERANCE "CHATTER-FREE" ECONO-SINKS

A set of six of the most popular sizes of countersinks packed in convenient container with separate space for each of the six sizes, has been produced by the Severance Tool Industries, Inc., 631 Iowa St., Saginaw, Mich.

The outside diameters range from ¼ through 1 in. They are available for immediate delivery in 30-, 41-, and 45-deg. angles. Made of high speed steel they cut fast and clean on a wide range of

(Continued on page 31A)

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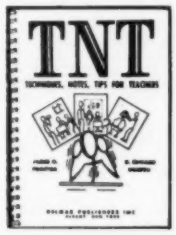

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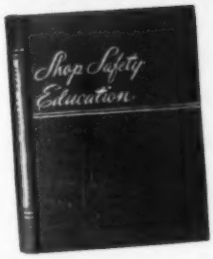

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SHOP EQUIPMENT NEWS

(Continued from page 28A)

Chatter-free Econo sinks

materials producing smooth, accurate seats. They can be reground by the manufacturer at a fraction of their original cost giving new tool performance each time they are reground.

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For brief reference use IAVE—0204.

THE NEW HOTPACK ELECTRIC PLASTIHEETER

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Some of the features of the plastiheeter are:

Case is fabricated entirely of aluminum and remains cool to the touch while heater is in operation.

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Nichrome heating element is encased in a ceramic holder which permits easy replacement if necessary.

Unit is so constructed to allow an air circulation between the heating element and the unit itself. Safe for any child to use.

Can be operated in bed, on the lap, and on the table.

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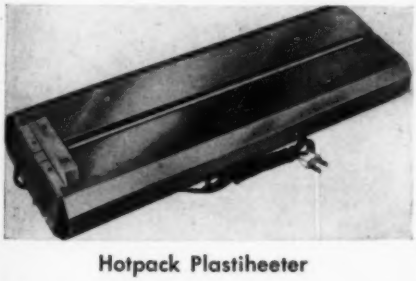

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For brief reference use IAVE—0205.

BALL HEAD RATCHET WRENCH

A new streamlined type ratchet wrench has been placed on the market by the Blackhawk Mfg. Co., Milwaukee 1, Wis.

Designated as the "ball head" design, this new design offers a compactness which is particularly important to the user when getting into cramped quarters, plus a design that prevents accidental reversing.

This latter feature was accomplished by recessing the reverse button so that the mechanic grasp cannot accidentally reverse it.

The new styling has resulted in greater strength in the ratchet head housing, greater efficiency, and smoother operation.

According to Blackhawk, the ball head design is currently appearing on their 1/2-in. and 7/16-in. wrench drives and will eventually be standard on all drives in the line.

Ball head ratchet wrench

For brief reference use IAVE—0206.

NEW SHORT-ASSEMBLY GLUE

The Borden Company's Chemical Division is introducing a new *one shot* glue for tapeless veneer splicing machines that incorporates both a lubricant and a short-assembly catalyst. Simple to mix and easy to handle, the dry powder urea resin glue is specially formulated for high-speed splicing of thick or thin veneer. It can be used on either resistance-heated or R/F-heated tapeless splicers. The resin powder is identified as "Cascamite TS-24." It can be applied by spray, brush or roller spreader at the veneer jointer or splicer. For short assembly, it need only be mixed with water. For long assembly, a supplementary catalyst is added.

For brief reference use IAVE—0207.

(Continued on next page)

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SHOP EQUIPMENT NEWS

(Continued from previous page)

A NEW THING IN ART METALCRAFT

An entirely new idea for metalcraft work, consisting of preformed aluminum or copper circles, has been introduced by Metal Goods Corp., 5239 Brown Ave., Dept. I.A., St. Louis, Mo.

With these new preformed metal circles, no cutting or forming is necessary to fashion colorful, attractive trays, coasters, and other useful items. In this manner, both beginners and experienced craftsmen will find their handicraft work speeded up, and their finished jobs will have a more professional appearance.

Preformed circles of aluminum and copper

To prepare the preformed circles for decoration, the worker need only trace the design or pattern right on the metal. Then, color it with a special Metal Goods Dek-All color, which comes in sets. These sets contain brilliant colors that adhere readily to the metal surfaces and are permanent. Applied easily with a paint brush, they are washable and chip resistant.

For brief reference use IAVE—0208.

BOOKLET ON NEW WOOD FINISHING PROCESS

The booklet, "Facts . . . on Preserving and Finishing of Beautiful Wood," is now available as a gift to our readers. It tells the story of modern penetrating wood finishes in producing a deep, rich, quality finish.

The new labor-saving system is outlined with all directions so that even the amateur or beginning student can obtain beautiful finishes on his wood projects.

You can receive this booklet gratis by writing to General Finishes Sales & Service Co., 1548 W. Bruce St., Milwaukee 4, Wis.

For brief reference use IAVE—0209.

CRAFT PATTERNS CATALOG

A catalog illustrating 500 projects has been made available by Craft Patterns, Box 206, Elmhurst, Ill.

The projects cover toys and play equipment; outdoor and indoor furniture, cabinets, etc., garden and lawn equipment; boats, canoes, and fishing skiffs; garages and summer home cottages.

Full-size patterns for all of these projects can be obtained very cheaply.

Enclose 25 cents for a copy of this catalog.

For brief reference use IAVE—0210.

THE PEASE CATALOG

A 238-page catalog on blueprinting machinery and accessories; whiteprinting (dry direct process) machinery; blueprint, negative, and whiteprint paper; drafting-room furniture; and photographic arc lamps, etc., may be obtained by writing to the C. F. Pease Co., 2601 West Irving Park Road, Chicago 18, Ill.

It is fully illustrated and shows the many types of blueprinting and drying machinery and other drafting room equipment made by this firm.

For brief reference use IAVE—0211.

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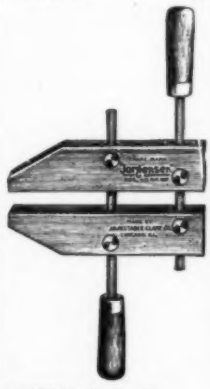

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Jaws are clear, straight grain hard maple, properly seasoned and manufactured in our own shop. Cold-drawn steel spindles. Hard maple handles that will not come loose. All parts carefully fitted for smooth, trouble-free operation.

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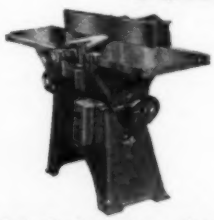

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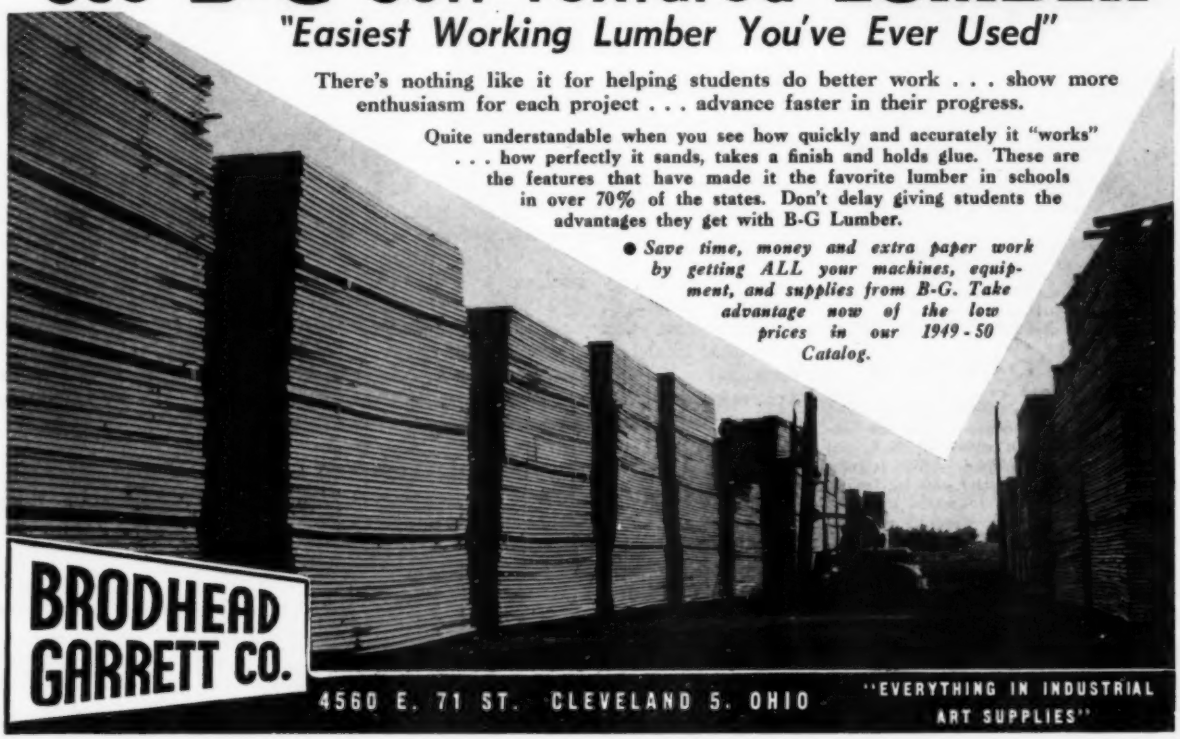

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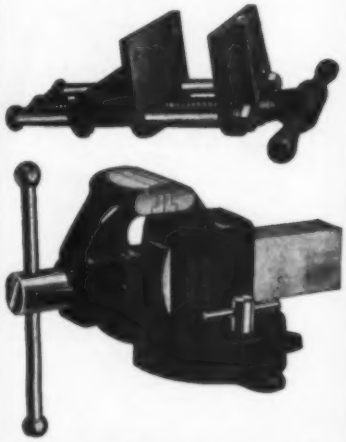

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ELEMENTARY AUTO MECHANICS

(Continued from page 26A)

The rest of the connections should be made starting next to the first wire, going around the cap in the direction the rotor turns, and connecting to the rest of the spark plugs in firing order.

6. Check over the wiring for errors before trying to start the motor, and recheck if the motor fails to start after *three short* depressions of the starter switch.

Questions:

1. What would happen if the distributor point contact bolt dropped down against the distributor case?
2. Why use heavy insulated wire in the secondary circuit?
3. Why must primary connections be made much more securely than secondary for proper operation?

Text reference: ....

(To be continued)

New Publications

Ornamental Tin Craft

By Chris H. Groneman. Cloth, 152 pp., 5¾ by 8¼ in., illus., $3. The Bruce Publishing Co., Milwaukee 1, Wis.

The author of this book has gone to great lengths to make the use of the despised tin can a source of materials for making truly worthwhile, and in most cases, very appealing projects that will please the student and the home crafter.

Knowing that most tin cans are made of comparatively light stock, he shows the beginner a method for sweating two pieces of the tin together. Also, to make the projects more appealing, he has devised a small, low-cost copperplating outfit which can be made without much trouble, and which will copperplate the finished projects.

The tools for forming and decorating the metal are described and their use is shown by excellent illustrations. The processes of cutting and preparing stock, piercing, filing and dressing edges, forming, chasing, etc., also are clearly explained.

Then follow 35 well-designed projects, all accompanied with step-by-step directions.

Many students and home crafters will be delighted with this book.

Machinery's Handbook

By Erik Oberg and F. D. Jones. Cloth, 1911 pp., 5 by 7⅛ in., illus., $7. The Industrial Press, 148 Lafayette St., New York 13, N. Y.

This is the 14th edition of this valuable reference book on machine design and shop practice. It is especially useful to engineers, designers and draftsmen, and machinists and toolmakers.

Its contents may be roughly divided into information and tables on mathematics, mechanics, strength of materials, gearing, bolts and screws, screw threads, limits and gauges, small tools, speeds and feeds, steel alloys, motors, and weights and measures.

This handbook has been favorably known since the appearance of its first edition in 1914, and it has been constantly improved and enlarged in succeeding editions.

Jewelry Making and Design

By Augustus F. Rose and Antonio Cirino. Cloth, 300 pp., 6¼ by 9¼ in., illus., $8.95. The Davis Press, Inc., Worcester, Mass.

A compendious text on the subject of jewelry and design by two artist educators who were pioneers in metal crafts and design.

(Continued on page 36A)

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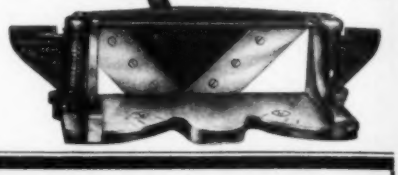

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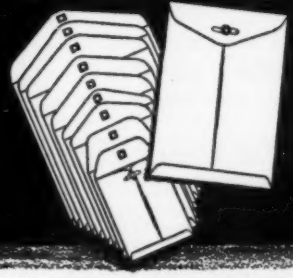

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NEW PUBLICATIONS

(Continued from page 34A)

Unfortunately, Mr. Rose has died, but his work exemplified in this text is ably carried forward by his gifted coauthor.

Modern Oscilloscopes and Their Uses

By Jacob H. Ruiter, Jr. Cloth, 326 pp., 6⅛ by 9¼ in., illus., $6. Murray Hill Books, Inc., New York City.

A book for radio and television servicemen, designers, and engineers, as well as a textbook for science teachers.

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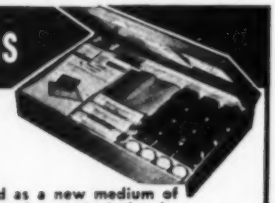

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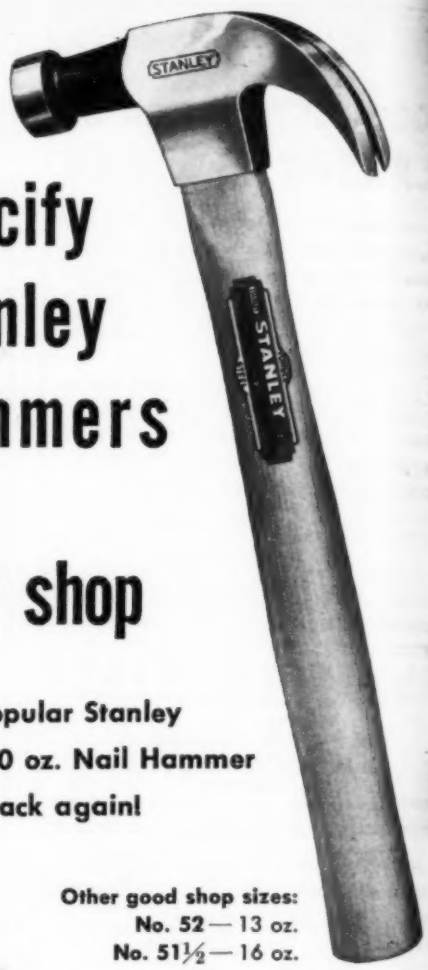

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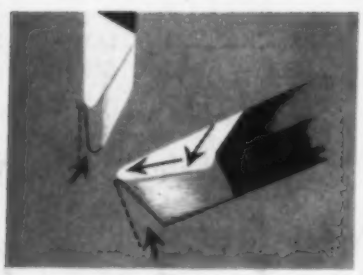
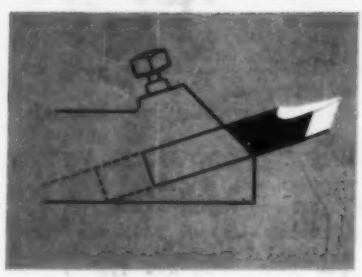
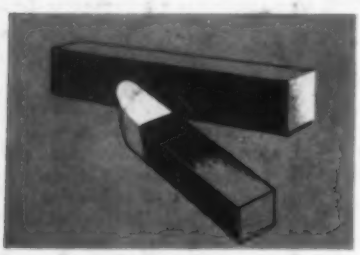


1. TO CUT FREELY, a tool must be ground with four correct angles—side clearance (above) and back rake, side rake and end clearance (below). These angles as well as the shape of the tool vary with the material to be machined. Refer to a tool manufacturer's manual on this point.



2. THE MOST SATISFACTORY WAY to grind a tool bit is in its own holder. To prevent grinding the holder, extend the tool beyond its regular cutting position.

3. THE TOOL IS SUPPORTED on the work rest and moved over the entire face of the grinding wheel. This prevents the tool from turning and distributes wear on the wheel.



4. TOOLS SHOULD BE further sharpened with light strokes of an India oil stone. Use of this stone is also recommended between cuts.

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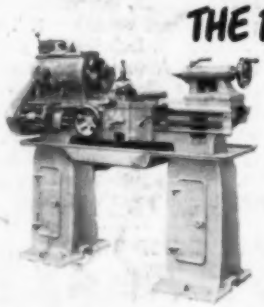

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